

Aviation Week

and *Space Technology*

75 Cents

A McGraw-Hill Publication

June 13, 1960

SPECIAL REPORT:

RF-101C Wing Photo Mission

Avco Mk. IV Re-Entry
Tracked From C-54



Avco
Research & Advanced Development

AEROJET FOR UNDERWATER INTELLIGENCE

Our Atlantic Division at Frederick, Maryland, comprises an expert staff of mathematicians, electronic engineers, geophysicists and acousticians. Their specialty: research, development, and production of underwater intelligence systems for anti-submarine warfare.

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Engineers, scientists—investigate outstanding opportunities at Aerojet.



Solid State Components from Hydro-Aire may Solve Your Electronic Systems Problem

Today, Hydro-Aire offers you special skills in the development of solid state components to help you solve your systems problems. The Hydro-Aire Electronics Division has been created, staffed and tooled to provide flexibility in design, on-time delivery and reliable performance. These capabilities are now producing precise answers for project managers at Martin, Boeing, Space Technology Laboratories, General Electric, Latham Industries, Magnavox, Autonetics, and many others.

For a prompt answer to your inquiry, write Electronics Division, Hydro-Aire, 3060 Winona Avenue, Burbank. A note on your letterhead to sign your copy of our new Electronics Brochure.

Qualified Electronics Engineers are invited to investigate opportunities at Hydro-Aire by contacting Mr. Harold Grievke.

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NORTH & SOUTH DIVISIONS

Solid state components for
defense, space, and
communications systems.

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SERVO-SYSTEMS OF FORCE CONTROL



With 35 years experience Sargent builds precision linear and rotary hydraulic, pneumatic, mechanical and electronic systems of force control to meet increasingly the increasingly high requirements of aviation, aircraft, marine, petroleum and industrial use. From original idea to finished product—SARGENT.

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Plating, all types
Inspection
Assembly

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Hydraulic Valves

Hydraulic Pumps
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"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.
— U. S. Supreme Court

AVIATION CALENDAR

June 29-30-Security Council Meeting
American Institute of Electrical Engi-
neers, Cheltenham-Holmes Hall Hotel, W.
Isle, N. J.

June 30-Military Conference on Steel
Tube and Electronic Manufacturing
Boeing Laboratories, Boeing Co.,
Compton, Calif.; of Radio Engineers
Professional Group on Instrumentation,
Radio Research Laboratory, National Bu-
reau of Standards, American Institute of
Electrical Engineers, Instrumentation Di-
vision

June 29-30-50th Annual Meeting, Institute
of Navigation, U. S. Air Force Academy,
Colorado Springs, Colo.

June 28-July 1-1950, Special Meeting and
Apparatus Exhibit, American Society for
Testing Materials, Cheltenham-Holmes
Hall Hotel, W. Isle, N. J.

June 27-28-Forth National Conference on
Military Electronics, Institute of Radio
Engineers, Sheraton-Park Hotel, Wash-
ington, D. C.

June 28-July 1-National Summer Meeting,
Institute of the Aeronautical Sciences,
Anderson Hotel, Los Angeles, Calif.

July 1-4-50th Annual Post-War Na-
tional Championships (cricket, closed
except regular meet), Fort Wayne, Ind.

July 1-14-Special Summer Program on In-
strumentation—Theoretical and Labora-
tory, Massachusetts Institute of
Technology, Cambridge, Mass.

July 1-14-Continuation on Program of
Study in High Velocity Deformation,
Smoker Hotel, Fort Park, Calif. Open
to Metallurgical Society of the Ameri-
can Institute of Mining, Metallurgical
and Petroleum Engineers.

July 10-19-Liquid Rocket and Propellant
Conference, American Rocket Society,
Glen House Building, Ohio State Univer-
sity, Columbus, Ohio

July 28-29-Sixty-fifth Annual Symposium on
(Continued on page 6)

AVIATION WEEK and Space Technology

June 15, 1950

AVIATION WEEK and Space Technology
will be held at the Sheraton-Park Hotel, Wash-
ington, D. C., June 15-19, 1950. The program
will include a series of lectures, demonstrations,
and exhibits. The lectures will be held in the
main ballroom of the hotel. The demonstra-
tions will be held in the adjacent auditorium.
The exhibits will be held in the adjacent
hallway. The program is open to the public.
Tickets are available from the American
Institute of Aeronautical Engineers, 1200
K Street, N. W., Washington, D. C.

The program is open to the public. Tickets
are available from the American Institute of
Aeronautical Engineers, 1200 K Street, N. W.,
Washington, D. C. The program is open to
the public. Tickets are available from the
American Institute of Aeronautical Engineers,
1200 K Street, N. W., Washington, D. C.

For more information and complete operating specifications, write
or wire SM/I Inc. Address your inquiry to Stanley M. Ingram,
Capitol City Engineer

Engineering notes
from the

SM/I REPORTER

BY STANLEY M. INGRAM, Capitol City Engineer



Report No. 6

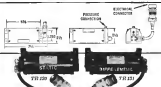
TR 130 Absolute Pressure Transducer and TR 131 Differential Pressure Transducer

These SM/I pressure transducers are precision built 400-cycle
instruments using a cruciform cross-section helically twisted
Bourdon tube with an electromagnetic pick-off to generate an
electrical signal proportional to absolute pressure (TR 130) or
differential pressure (TR 131) for use by computers and
precision instrumentation. The design completely eliminates any
mechanical friction or stiction and reduces hysteresis to an
absolute minimum. The relation between output voltage and
input pressure is linear.

They are particularly well adapted for use in aircraft because
of high accuracy, low threshold, rugged, compact design and
inherent repeatability of performance. The units have a mean
time to failure of over 5000 hours based on in-flight opera-
tion. They meet the requirements of military specifications
MIL-E-5400.

Typical Performance Specifications

Static range 0 to 1000 psi (absolute)
Output range 0 to 100 mV (typical)
Sensitivity 1 mV/psi (typical)
Linearity ±0.1% (typical)
Hysteresis ±0.1% (typical)
Repeatability ±0.1% (typical)
Frequency range 0 to 400 cps
Impedance 500 ohms (typical)




For more information and complete operating specifications, write
or wire SM/I Inc. Address your inquiry to Stanley M. Ingram,
Capitol City Engineer

SM/I

SERVO-MECHANISMS/INC.
Los Angeles Division
12500 Aviation Boulevard
Newport, California

Latest high-temperature capacitor from AIRBORNE permits continuous duty at 700°F



STANDARD SIZES

PART NO.	MEAS.	TEMP.	SIZE	STYLE
26-100	100	1.50	1.00	A, B, C
26-1	1	1.50	.275	A, B, C
26-25	25	1.50	1.00	A, B, C
26-5	5	1.50	1.00	A, B, C
26-10	10	1.50	1.00	A, B, C
26-20	20	1.50	1.00	A, B, C

Designed for operation with high-temperature aircraft turbine engines, this newest addition to Airborne's line of miniature capacitors offers a working temperature range of -55 to +700°F—without voltage derating and with low capacitance variation.

As a dielectric for this new Airborne capacitor, we use a mixture of thin, pure resin—because this mixture is chemically stable at temperatures up to about 700°F. The conductor is aluminum foil, and the completed unit is encased in a titanium shell with maximum corrosion resistance. A new copper spray technique has also been developed to provide high-temperature connections. For terminals a special ceramic is used. These and other refinements provide the characteristics listed in the column opposite.

If you have requirements for high-temperature re-workable capacitors, consult Airborne's technical assistance, or write to: Airborne Capacitors, Inc., 11111 Wilshire Blvd., Los Angeles, Calif. 90024. Contact city or out address or write for Product Bulletin PB-10A.

STANDARD CHARACTERISTICS—AIRBORNE HIGH-TEMPERATURE MICA CAPACITORS
 Temperature: -55 to +700°F
 Rated voltage: 500 VDC
 Dielectric loss: 0.0005 VDC and 200 V
 Dielectric constant: 100, 1st
 Dielectric constant: 100, 2nd
 Dielectric constant: 100, 3rd
 Dielectric constant: 100, 4th
 Dielectric constant: 100, 5th
 Dielectric constant: 100, 6th
 Dielectric constant: 100, 7th
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 Dielectric constant: 100, 99th
 Dielectric constant: 100, 100th



Engineered Equipment for Aircraft and Industry
AIRBORNE ACCESSORIES CORPORATION
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AVIATION CALENDAR

- (Continued from page 5)
- Comptech and Data Processing, Denver Research Institute, University of Denver, Stanley Hotel, Estes Park, Colo.
 - Aug. 13-14—Fourth Global Communications Symposium, Boulder-Hilton Hotel, Washington, D. C. Sponsors: Institute of Radio Engineers, U. S. Army Signal Corps.
 - Aug. 13-14—Tenth of National Military Aviation (Cavalry Meeting), Institute of the Association of Engineers, 20 Center Blvd., San Diego, Calif.
 - Aug. 21-22—Naval U. S. National Security Communications, Essex County Airport, Orono, Me.
 - Aug. 23-24—National Meeting, American Astronautical Society, Orange Hotel, Seattle, Wash.
 - Aug. 24-25—1965 Pacific General Meeting, American Institute of Aeronautics and Astronautics, 1111 Wilshire Blvd., Los Angeles, Calif.
 - Aug. 25-26—11th Annual Congress, International Astronautical Federation, Royal Institute of Technology, Stockholm, Sweden.
 - Aug. 26-27—Second International Symposium on Statistical and Space Medicine, Laboratory of Statistics and Space Medicine, University of Colorado, Boulder, Colo.
 - Aug. 28-29—1965 Congress, Engineering Conference, University of Colorado, Boulder, Colo.
 - Aug. 29-30—Western Electronic Show & Convention, Institute of Radio Engineers, Sheraton Hotel, Los Angeles, Calif.
 - Aug. 30-Sept. 1—1965 National Air Rally, Westport Airport, Orange, Mass. Sponsors: National Aeronautics Association.
 - Sept. 1-2—Civilian, General Aviation, Royal Air Force, Lydney, England.
 - Sept. 3-4—1965 Pittsburgh Photo Display and Exhibition, Society of Photo-Optical Engineers, Pittsburgh, Pa.
 - Sept. 5-6—1965 Engine and Operations Symposium, Northrup Corp., Midvale, Colo.
 - Sept. 12-14—1965 Annual General Meeting, UFA, Copenhagen, Denmark.
 - Sept. 15-16—Second International Congress, International Council of the Association of Engineers, Zurich, Switzerland.
 - Sept. 16-17—Annual Meeting, National Association of State Aeronautics Officers, West Hotel, Washington, D. C.
 - Sept. 17-18—1965 Annual Meeting, Annual Photo Chemical Assn., Sheraton Park Hotel, Washington, D. C.
 - Sept. 18-19—1965 Symposium on Space Technology and Technology, Institute of Radio Engineers, Sheraton Hotel, Washington, D. C.
 - Sept. 21-22—National Convention and Aerospace Symposium, Air Force Assn., Convention Hall, Brooks Hall, San Francisco, Calif.
 - Sept. 23-24—Power Systems Conference, American Society of Mechanical Engineers, Santa Monica, Calif. Sponsors: USAP, U. S. Army, U. S. Navy, National Aeronautics and Space Administration, American Society of Mechanical Engineers.
 - Oct. 1-2—Fourth Annual Meeting, Institute of Radio Engineers, Pasadena, Calif. Sponsors: Ohio State University, National Aeronautics Association.



At The Ramo-Wooldridge Laboratories... integrated programs of research & development of electronic systems and components.

The new Ramo-Wooldridge Laboratories in Canoga Park provide an environment for creative work in an academic setting. Here, scientists and engineers seek solutions to the technological problems of today. The Ramo-Wooldridge research and development philosophy places major emphasis on the imaginative contributions of the members of the technical staff. There are outstanding opportunities for scientists and engineers. Write Dr. Richard C. Potter, Head, Technical Staff Development, Department 10-F.

THE RAMO-WOOLDRIDGE LABORATORIES
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An electron device permits scientists to study the behavior of charged Bell particles fired in superconducting.

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AIR DIV



BELL "IROQUOIS" JOINS FAMED STRAC DIVISIONS*



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"The Iroquois proved 'flexible' when combined with the Bell forces that saw action in Vietnam. As a result, their mobility, maneuver and speed support units have received unprecedented recognition in the quality of their performance."

FEATURES OF BELL HU-1A PROVED IN THE FIELD BY STRAC

- **Air Transportability**—canopy and aircraft removable in C-119, C-130 and C-130 aircraft.
- **Vertical Takeoff-Lift**—up to 100 fully equipped men.
- **External Cargo Capacity**—up to 2,000 pounds (standard Army payload).
- **Medical Evacuation**—initially actual evacuation, after 1968 NRE.
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- **Minimum Helicopter Maintenance**—high availability, proved in testing, upheld in field.

For operational turbine-powered flights, look to **BELL** HELICOPTER CORP.

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Leads in Joint and Coupling Engineering



Featured at the left are a few of the many V-Band Couplings and Joints designed and produced by Marmar for every aircraft and missile application. Marmar V-Band Couplings are used for coupling all sizes of tubing, piping and ducting used in fuel, heater and structural applications. The lightweight Marmar J113 V-Band Joint provides efficient sealing for gas, steam and hot oil or gas lines. The J113 V-Band Joint may be used for fuel systems. Marmar high-performance CONHOGAL Joints provide a lightweight and ultra-low leakage is required over a wide temperature range.

Call on Marmar's 30 years of experience when you have a joint or coupling problem. Highly skilled and experienced engineers are ready to be of assistance to you. Also send for the new Marmar Catalog No. 850 showing hundreds of joints available from stock.

Circle 1 on Reader Service

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MARMAR DIVISION

10311 Exposition Blvd., Los Angeles 44, California
Aeroquip, V-Band Couplings and Flanges, Joint and Seal Air
Couplings, Conhocal Joints, Helicopter Couplings, Bellows,
Gaskets and Gasket Joints

Mr. W. W. Wills, Chief Engineer of Marmar Division, displays some of the many couplings and joints developed by Marmar engineers.

A WIDE PERFORMANCE RANGE IS POSSIBLE THROUGH DIFFERENT FLANGE AND GASKET DESIGNS AS ILLUSTRATED



STANDARD flange couplings and flanges for high strength standard couplings of all sizes and all types of tubing.



V-BAND couplings for high strength and low weight couplings for all sizes and all types of tubing.



CONHOGAL flange couplings for high strength and low weight couplings for all sizes and all types of tubing.



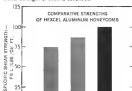
BELLOWS flange couplings for high strength and low weight couplings for all sizes and all types of tubing.

20% More Strength... 20% Less Weight

Permit New Applications of HEXCEL Honeycomb

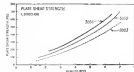


Hexcel meets the critical need of today's jet aircraft and missiles for stronger aluminum honeycomb with new 5056 alloy, conservatively 20% stronger than any existing aluminum core of the same weight. This important development by Hexcel not only makes possible further reduction in weight of existing honeycomb applications, but offers opportunities for a wide range of new design applications where the additional strength of 5056 is essential.



Hexcel 5056 honeycomb is the result of four years' research and study of more than 100 materials, including 10 aluminum alloys, and represents the first major improvement in aluminum honeycomb since 1954, when Hexcel introduced its 5052 alloy honeycomb to the industry. 5056 alloy contains the same metals as Hexcel's 5052 and 3003, with a significant increase in magnesium content. Current tests indi-

cate that 5056 has very nearly the highest strength-to-weight ratio of any aluminum honeycomb ever made, but without the corrosion problems usually associated with high-strength aluminum alloys. New 5056 honeycomb offers an immediate solution to design problems of weight and strength in the aircraft and missile fields, as well as applications in electronics, construction, lighting and packaging.



In comparison with 5052 alloy, 5056 shows an improvement in bare compressive properties of approximately 25% which is 250% of specification minimum. Shear strengths are at least 20% above 5052 and 50 to 100% above specification minimums. 5056 cell sizes are $\frac{1}{8}$ " to $\frac{1}{4}$ "; foil gauges .001" and .002". For detailed test results and complete data on Hexcel's 5056 honeycomb, write Dept. 4-E.



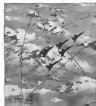
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World's largest Manufacturer of
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A Technique Called Vector
evaluates and displays pertinent information on all air activities within the zone of interest only. That's because this can track and keep running many high speed maneuvering targets. Furthermore, this system and its computerized capabilities is available in increments from one system item for communications system to eight systems and sensors in the system.



The Control Function results in establishment of tactical air activity assigned by the command center. Forward processing of targets, all aspects of a given target, such as, location, altitude, and course, results in many coordinated functions. The resulting computerized data is then used to determine the target's position, and points the assigned sensor to the target. This is a continuous process, providing a greatly improved accuracy and command system.



Communications is accomplished in providing all necessary information, such as, target location, altitude, and course, results in many coordinated functions. The resulting computerized data is then used to determine the target's position, and points the assigned sensor to the target. This is a continuous process, providing a greatly improved accuracy and command system.

From the REMINGTON RAND UNIVAC

Military Division

TACS—combining data processing, communications and control functions—demonstrates total systems capabilities.

A significant example of the capabilities of the Remington Rand Univac Military Division is the AN/TSC-13 Tactical Air Control System. This USAF System not only performs air to air tasks, evaluation and control functions in a 100-1000 square mile area, transmitting the information every 30 seconds to facilitate command decisions.

The responsibility of the System allows Control and Reporting Centers to be quickly moved into forward positions to give surveillance of tactical territory. A computerized data network, involving both voice and digital techniques, coordinates these functions with weapon groups and other military activities in successfully meeting the fast-changing needs of the tactical air situation.

Designed and built by the Military Division, the Tactical Air Control System fully integrates the computer, communications and control functions. The System represents a solution to a complex problem and exhibits the characteristics which have become identified with Remington.

Read Univac advertisements in the military area—computer use, high speed of operations and reliability under demanding environmental conditions.



UNIVAC®



**Remington Rand
UNIVAC**

DIVISION OF SPERRY RAND CORPORATION
Maine Park, Dr. Paul 10, 40 months

Other models and data systems developed by the Remington Rand Division are also available for the U.S. Navy.
ATLAS, the Surface Warfare Computer for the USN-AS Fleet
HQS-100
BOMARC Target for the U.S. Air Force Target Program Project.

SEA SURVEILLANCE SYSTEM FOR THE U.S. NAVY
AN/USP-10 Universal Computer for the U.S. Navy
Additional information describing capabilities and applications is available from the Remington Rand Military Division.

ESCAPE SLIDE

another product of Air Cruisers research



NEW ESCAPE SLIDE SAFETY FEATURE

This flexible escape slide developed by Air Cruisers for jetliners provides rapid and safer emergency evacuation of passenger aircraft, particularly at extreme aircraft attitudes.

The passenger's speed of descent is automatically reduced by his own body weight bending the last portion of the flexible slide closer and closer to a horizontal attitude as he nears the ground. Rate of descent is virtually stopped as the passenger eases off the final

few feet of slide resting perilous on the ground.

Simple to operate, Air Cruisers escape slides are standard equipment on many turbine-powered military and commercial aircraft.

The Air Cruisers jet pump, which produces rapid inflation vital to the fast, dependable operation of escape slides, is yet another contribution toward better survival equipment by America's most experienced fabricator of inflatables from rubberized nylon materials.

Your requirements are unlimited

THE GARRETT CORPORATION



AIR CRUISERS DIVISION

SECON, NEW JERSEY

LIFE JACKETS • LIFE RAFTS • COLLECTOR JELCOES • ESCAPE SLIDES • GAS PROTECTORS • GAS PROTECTORS

If profitable arc-welding is important to you, then you ought to investigate the complete line of modern Harnischfeger equipment. For example, P&H weld-programming with motorized rheostat or sequence-timers enables you to weld Space Age and other super-critical metal **automatically!** Or you can automate your welding with P&H punched-tape control. Both are infinitely versatile and standardize weld quality at levels impossible with manual controls. P&H also offers you industry's most complete line of industrial welders — 1 to 750 amps. — AC, DC, or dual AC/DC machines with h-f, spot gun, and gas and water controls. And P&H engine-driven welders give you compact, self-contained 25- to 500-amp. weld-power for field jobs. The different types of P&H electrodes enable you to match the analysis and properties of many weldable parent metals. And you can cut welding labor and overhead costs in half with P&H welding positioners. So...



WELD MODERN WITH P&H EQUIPMENT

Literature available on all products.

Export Division
Harnischfeger Corp., Milwaukee, Wis.
P&H welding equipment is manufactured and sold in Canada by Harnischfeger Canada Ltd., 100 King St. West • Toronto, Ontario, Canada.



HARNISCHFEGER
WELDERS • ELECTRODES • POSITIONERS
MILWAUKEE 46, WISCONSIN



A3J—the most versatile Mach 2 airplane in the world today

Probing the horizons of the Free World, hovering on the fringe of human vision, bolstering the ease of world peace by its omnipresence in the sky—this is the job for the Navy's new A3J Vigilante.

Designed and built by the Columbus Division of North American Aviation, the A3J has a versatility unmatched by any other Mach 2 airplane in the skies today. It is equipped to handle a variety of nuclear or conventional weapons for either limited or all-out nuclear war. It has the speed and maneuverability to fly single plane attack missions without fighter escort.

The Vigilante can fly through the atmosphere faster than the earth turns beneath it; yet can throttle down to comfortable landing speeds for carrier decks—or small fields ashore. It is also suitable for prompt response counterattacks that make it ideally suited for low-level missions over irregular terrain. Its speed and maneuverability plus the most advanced fire control system known make it a single airplane with an outstanding dual capability—high performance attack or long-range interception.

The A3J Vigilante truly is a significant addition to the U.S. arsenal dedicated to preserving world peace.

THE COLUMBUS DIVISION OF NORTH AMERICAN AVIATION, INC.



FOR THE AIR FORCE, MSVD developed experimental 12-foot rotating ICBM recovery vehicle, the RV-2, largest ever to be recovered. Vehicle, with its necessary guidance system, was developed for General Electric by Clark Research Laboratories, is shown here being hoisted on board ship.

MISSILE AND SPACE VEHICLE
DEPARTMENT

...center for missile and space technology research
and development at General Electric

Progress in search and recovery

With each recovery of a space vehicle, scientists gain important new knowledge about the environment of space and its potential effect on man and the operation of vehicles and equipment. As more advanced vehicles are developed for space flight—some with life aboard—successful location and recovery become increasingly vital.

General Electric's Missile and Space Vehicle Department pioneered in the development of space vehicle search and recovery techniques as part of its re-entry and recovery vehicle program for the U.S. Air Force. MSVD developed and built the first payload to be recovered from space—an 18-inch data capsule ejected from an Air Force Thor re-entry vehicle on June 13, 1958. Many such data capsules have since been recovered from both Thor and Atlas flights—some carried cameras providing film from space. MSVD also developed and built the 12-foot long, one-ton re-entry vehicle shown above, which the Air Force recovered on July 21, 1960—the

largest to be recovered to date. Today, as MSVD builds and flight tests more complex vehicles, it is continuously expanding and improving its already successful search and recovery program.

Currently, this search and recovery experience is being applied to the development of such important space programs as the Air Force "Discoverer" recovery satellites and NASA's advanced research recovery vehicles (RRV).

For more information about MSVD's work in search and recovery, write to Section 100-72, General Electric Co., Missile and Space Vehicle Department, Philadelphia 4, Pennsylvania.

GENERAL ELECTRIC

MISSILE AND SPACE VEHICLE DEPARTMENT
A Department of the Defense Electronics Division

Scientists and Engineers interested in career opportunities in Space Technology, contact Mr. T. H. Sebring, Dept. 140, MSVD



NEW MICRO-DIFFERENTIAL PRESSURE METER



"A NEW INSTRUMENT BASED ON
THE PATENTED DECKER T-42
INNOVATION TRANSDUCER

Now you can measure differential pressure from ± 0.0007 H₂O to ± 169 H₂O with a single sensitive and economical pressure meter. Differential pressure can be read directly from the new Decker Model 306-2 Meter, or the 10 Vdc full scale analog output can be fed to external displays, recorders, or control devices.

The entire range of pressures is covered with just a single interchangeable Series 306 Sensors. Each contains

a precision, corrosion-proof two chamber capsule. Any displacement motion is moved by a reference pickup that mounts negligible co-axial force on the diaphragm. Minute capacitance changes are converted by the T-42 Isolation Transducer to large analog output voltages indicating direction as well as magnitude. The instrument is capable of 0.05% resolution.

Given a suitable vacuum reference level, you can use the 306-2 to

take accurate measurements down to 3 meters. Equipped with a jetted water tube or orifice, the unit will measure gas flow velocities as low as 0.10 sec. And the 306-2 has proved itself ideal for measuring small physiological pressures, as in digital plethysmography.

Complete details on the meter are in Data Sheet 306-2. The Sensors are covered in Data Sheet Series 306. Write The Decker Corporation, Beta City, New York, Pennsylvania.

THE DECKER CORPORATION Beta City, New York, Pennsylvania



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sion complexity... for surface ships, precision torpedo fire control and hydrofoil stabilization and control systems.

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A solid-propellant missile that will be launched from ocean depths. A nuclear-powered submarine that will cruise for months without surfacing. The Navy has combined them in the Fleet Ballistic Missile system. Each nuclear sub will be a mobile missile base, capable of patrolling 70% of the earth's surface, ready to launch 36 Polaris missiles in as many minutes. Aerojet General furnishes the propellant for the Polaris missile. General Electric the guidance. Lockheed a prime contractor and system manager.

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Second stage of Polaris test vehicle, which has instrumented container on its nose, separates and ignites after first stage has barked at zero speed.

There are two new aircraft development programs looming on the horizon that need some extraordinary effort from the aerospace industry and the executive and legislative agencies of the government if they are to achieve any significant success in adding to our national stature. These programs will be dependent on the technical resources of the aerospace industry and, at least in one program, dependent on new and more effective utilization of these total resources. They will also require some new working relationships between the Air Force and the Federal Aviation Agency, as well as possibly sustained legislative and funding support from the Congress.

Both of these programs now be attacked on the grounds that they will serve *only* the special interests of the aerospace manufacturing and transport industries. But we doubt if these arguments will long survive the glare of full public scrutiny. Actually, both programs offer the opportunity for substantial national dividends on our annual federal investment and can produce major improvements in our civilian economy and our military posture. These programs are:

• **Development of a workhorse jet-powered cargo plane:** This is an urgent need for both civil and military regions alike. The critical needs of MATIS for a workhorse jet cargo plane to replace its aging fleet of C-124 piston-powered transports, which slow military air logistics to a Panchen's pace in a race here or, have been well defined and substantiated. It is also evident that the military, airline potential, the civil airlines and the national economy would benefit greatly from a joint development program to meet this requirement.

It is true that all previous efforts to develop a service to serve both military and civil purposes have bogged down in the issue of specialized military requirements and splintered on the alleged ideological biases of the archivists, who feel that a different colored cloth is not a basic policy matter. However, we are reaching the point where some of the highly competitive ideological biases of the archivists and some of the military detail archivists must be subordinated to the law, purpose and goal of a new type service that will do the military job and can also be operated by archivists at a profit.

We are suspending now of the specialized craft for overall military cargo such as the C-330 fleet designed to carry ICBMs, but of the intermediate class of cargo transporters designed to carry all but this special outboard military cargo. This requirement has been tentatively defined in a USAF strategic operational requirement; some components have done considerable preliminary design study toward it, FAA and USAF have coordinated on it far more than has been usual, and Congress appears ready to approve a \$50 million investment in the Fiscal 1966 budget to start the development ball rolling.

This is a truly worthwhile project from the overall national interest. It will help plug a generally admitted critical gap in military airlift capacity. It will also lift the civil air cargo business off its modest platform and

Two Positive Programs

offer it as an opportunity to make a major contribution to a more efficient national economy through adding a major speed increment to the distribution system. It will provide an opportunity to develop a large military cargo-carrying capacity at very low cost through the operation of a profitable civil fleet of these aircraft which will be available in the immediate transport area that would result from either another localized war such as Korea or a full-scale nuclear conflict.

The technical state of the art is well able to handle this development problem immediately. The problem is executive decision, administrative coordination between all of the groups directly concerned and some vital leadership that will provide sustained drive and maintain a sense of positive national urgency behind this effort.

• **Development of a superpower status.** The national benefits from this project are less readily apparent than from the jet engine plane, but they are substantial. The increasingly recognized world leadership of this country is an import from the days of the DC-3 to the subsonic jet transport has not only been a substantial economic asset but tangible evidence of international prestige. The supersonic jet is the new Mach 2 or faster transport will represent another significant time compression in man's long effort to shrink the globe he inhabits. The nation that leads in this effort will gain significant international recognition, along with the peace and sense of boosted self-pride.

The program is of a technical and financial magnitude beyond the capability of any private industrial company or any single government agency. An effective organization of all national resources available in this area must be achieved and focused on this goal for any real prospect of success.

Federal Aviation Agency has been effective in keeping the National Aeronautics and Space Administration's impact aeronautical research facilities active on the problem (AW May 2, p. 60). Many individual engineers have led these designers exploring the possibilities beyond Mach 2. Unlike the jet-age plane, the supersonic transport still poses many unanswered questions and has state-of-the-art gaps in the broad technical spectrum its children cover.

Although it may well be premature to attempt the actual construction of a Mach-Zehnder transport sensor at each operational orbit site, it is certainly high time that a national effort be organized aimed at achieving this goal. The necessary research and development gaps should be defined and then filled, and responsibility for the leadership of this program should be assumed.

It will be a sad day indeed if the country runs second best in the international race to produce a speed, economical operational intensive transport.

These two programs for the development of a jet-powered cargo plane for both military and civil use and of a supersonic transport represent positive gains toward which both industry and government should address their very best efforts now.

—Robert Hays

—Robert Hertz

LIBRASCOPE COMPUTER FACILITIES

Shown below is a composite view of Librascope's facilities where a variety of computer systems are currently in different stages of design and production. Some are strategically involved with national defense...others deal with business and industrial process control. Each is uniquely designed to answer a particular need. The success of these systems illustrates the value of Librascope's engineering philosophy: A decentralized organization of specialized project teams responsible for assignments from concept to delivery...and backed up by excellent research, service, and

...and backed up by excellent research, service, and



production facilities
■ Librascope
Glendale, Calif.
Employment: ■



computers that pace man's expanding mind



Washington Roundup

Rockefeller's Challenge

Pressure for debate of defense and other defense issues dominated on the Rockefeller side last week. New York Governor Nelson Rockefeller started the push in dis-missing the views of Vice President Richard Nixon and pursuing an aggressive national platform of his own.

Rockefeller forced the issue on Nixon's decision not to discuss his own administration until after the Republican convention. The New York governor and his leading Republican enemies should make his program and policies known before the post-convention staff is confronting him. Nixon has possibly stuck to delaying present Republican policies on defense and other issues.

Rockefeller wants to spend an extra \$5 billion for immediate defense needs. He feels U. S. ICBMs are too few and too vulnerable to attack. He wants an airborne alert to protect the SAC bomber force, and he wants new bombers developed. More Polaris submarines and ground force modernization are also on his list.

Tighter equipping of the Defense Department as in the Rockefeller platform. So is a war-fixture, better balanced defense establishment and philosophy, one which would be made for all emergencies including local wars.

Rockefeller said handling of the U-2 incident is evidence of a need for better government examination to meet national and international problems. Sen. Henry Jackson also got into the U-2 controversy last week with his questioning of national policy. Jackson is Secretary of the Senate Select Committee on Intelligence in the late retirement in the House of Representatives.

U. S. approach to the disarmament problem was treated another theme of government machinery weakness. Rockefeller called for a more vigorous approach. He showed lack of preparation for disarmament conferences and the U. S. readiness merely to meet crises as they occur.

Disarmament Hopes

First hope for a disarmament statement has survived the summer trials. Soviet Union has proposed a new plan and the U. S. has promised to give it careful consideration at the Geneva disarmament meetings which resumed last week. Soviet proposal indicates a willingness to continue serious negotiations but Western negotiators are wary of promises calling for total elimination of nuclear weapons without restraint and control laws.

Big Gen. Hauer A. Boucher, who headed USAF's first space office at the headquarters level, is being assigned to head ARDC's Advanced Engineering Development Center. He will be replaced by Big Gen. Richard Connor, who has been heading space activities for Bell's Space Division.

Conrad will soon be late in the work of a second assignment. He will have Boucher's old job as assistant for advanced technology to Deputy Chief of Staff for Development Lt. Gen. Rocco C. Wilson and he will be deputy director of the new Systems Development Directorate which is headed by Maj. Gen. Vernon C. Bunker.

Maj. Gen. Victor R. Hagen has moved from director of development planning to assistant deputy chief under Wilson, replacing Maj. Gen. Leighton I. Davis, now head of Air Force Missile Test Center. Hagen is replaced by Big Gen. W. B. Kane in the planning job and Big Gen. Ralph L. Wessell is heading the new Directorate of Research and Technology.

Defense Department is studying the idea of centralized management of electronic supplies and material proposed by General Accounting Office. GAO estimates that centralized management could save more than \$25 million a year in administrative costs and through elimination of duplications.

AFMTC Independence

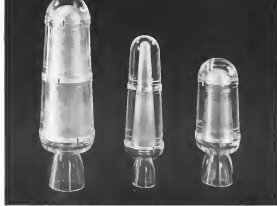
Wish for Air Force Missile Test Center to stay completely independent of Ballistic Missile Division as the ARDC incorporation process. This is a goal of critics plans to put the center under BMD in line with the pattern of placing all centers under one of ARDC's four new divisions.

Four major ARDC divisions will function passively as headquarters elements under the most recent concept. They will have staff direction functions, but not full command. BMD organization at Cape Canaveral will be strengthened, but AFMTC will retain its present level of autonomy. This shows gradually from this, but that the center has the two other services and NASA as much of its Atlantic Missile Range. With former ARDC commander Maj. Gen. Donald N. Yates coordinating range operations for the Defense Department, the Florida center's independence and administrative autonomy was even greater than it has in the past.

Col. Henry Bichel, head of the BMD detachment at Cape Canaveral, is returning to BMD headquarters. The full level is now division that will deal with installation and checkout of missile operations at field bases. Bichel is being replaced at AFMTC by Col. Paul Wignall.

—Washington Staff

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FLEXIBILITY of conical segmented solid propellant rocket motor concept being developed by United Technology Corp. is demonstrated with plastic models which have been filled with colored sand to show how motor of various throat configurations could be formed.

Segmented Solid Rocket Techniques Hold

MODELS of conical segmented solid propellant rocket motor (model at left) would be constructed in housing at bottom. Connections for joining segments are visible at base of each of two upper stages. Same rocket model is shown disassembled at right.



TWO-STAGE rocket model (left) is formed from conical segments. At right above, top segment of a motor assembly has been assembled to form a small conical segment rocket motor.



THREE-STAGE configuration has scored below the two top segments, another after the third segment and the third at the base of the rocket. Spent segments drop off in flight to lighten load, add cargo.

Promise for Big Boosters

Spaceborne, Cast-Solid propellant rocket manufacturing techniques already developed or being explored by United Technology Corp. under a contract with Northrop Associates and Space Administration are expected to eliminate the need for on-site loading of large solid boosters, cut cost and complexity of production and lessen the amount of development and test work necessary.

One of the most promising approaches to building very high thrust boosters of either the liquid or solid-propellant variety appears to be the building-block or segmented engine. This is now being explored for solids by a number of companies and is the approach required in USAF's upcoming 25-million lb./sec. competition (AVF Nov. 23, p. 32). It also is being investigated for liquid engines (AVF Feb. 1, p. 16).

United Technology claims an additional advantage for its approach on solid engines. Because the segments are conical in shape rather than cylindrical, with the small end at the top of the engine, the flow area increases in length

of the stage increases. This allows almost unlimited increase in length without cost, because providing more reliable protection of ballistic performance and decreasing the amount of testing necessary, according to William Behrendt, manager of the solid rocket branch.

Problems Overcome

United has fired a small conical segmented engine and says that all major design and fabrication problems have been overcome. The NASA contract (AVF June 4, p. 32) calls for demonstration of feasibility of the concept, using a small engine believed to develop less than 70,000 lb. thrust. United has proposed building an engine in the 1 million lb. thrust class, using segments about 10 ft. long and 10 ft. in diameter, and this approach can either be studied to form one long charge or have needles joined to each segment as group of segments to form a staged rocket.

Segments can be joined in the field with a single penalty of less than 10% added as method already developed.

tion for 1999 and \$7.5 million for the current fiscal year.

Both USAF Under Secretary Joseph V. Charni and the Air Force Scientific Advisory Board are aware of some aspects of USAR's current troubles, but most of its meetings are held out of the public eye. Detailed aspects of the current situation will be requested or not being reviewed will be by Maj Gen Victor C. Bonke, director of systems development of USAF headquarters by a committee headed by ARDC Commander Lt. Gen Bernard A. Schriener, who is covering segments of the work within the command and by a committee reviewing all activities and

other assignments in the command. An aspect that interests USAR systems more than most is that \$7 million in fiscal 1990 basic research contract funds added to the regular allocation, was distributed among four separate USAR-based committees. Each the USAF office had equipped to define and monitor research contract funds—research areas of that.

They are the result of what they consider a good decline in ARDC's appreciation of fundamental research. If the trend is correct, then USAF is certain to lose most if not all of the key members of a team of scientists that has been carefully built up

research contractual relationships in the past assignment.

•**Staff functions.** Administrative services, advanced planning, and some basic research and development now done by SLL will be transferred to Aerospace Corp. with SLL retaining systems engineering and technical direction for the future. The USAF's major systems systems. It is likely that SLL, probably will also transfer to USAF's request, a blue print for guidance of the new organization in the course of its staff functions. •**USAF probably will acquire SLL's facilities at the El Segundo Cold** research and development studies for use by both Aerospace Corp. and part of BMD. SLL, probably will require a new site, and its present research facilities to enhance its continuing contractual relationship with the USAF and begin its engineering activities in the space and missile field.

Ramo-Woodbridge work that benefits communications is a particularly complex one with SLL is expected to be taken over by SLL together with associated contract equipment and personnel.

This includes work on the Ramo-Woodbridge's Signal Technology Laboratory, which covers development of communications systems, communications equipment, advanced systems, infrared equipment, communications systems, systems research and field service and support.

Consideration also is being given to the transfer of Ramo-Woodbridge's Research Laboratory activities to SLL. This work includes programs in basic and applied research.

SLL will have space in the present company's Orange, Calif., Cold facilities to accommodate its new activities. This will supplement facilities in Los Angeles.

Space Surgeon Course Conducted by USAF

Capo Canaveral, Fla.—Last week for soldiers space surgeon began last week and is expected to train 10 men a year for a minimum period that will be able to support Project Mercury and other manned space programs.

Thirty eight medical instructors from the three service civilian government agencies and students will conduct a two-week training program under the direction of Col. George M. Kandel, Air Force Medical Test Center staff surgeon. Kandel has been training USAF medical officers for several years work for the past several years. He is a lieutenant colonel at AFMTC Commander Maj Gen. Frederick L. Davis in Dallas, who is head of all Defense Department Military support operations.

Aerospace Corp. to Replace STL; Gardner, Partridge Named to Board

Washington—Long delayed appointment of the new, non-profit Aerospace Corp. to replace STL (Technology Laboratories Inc., an Air Force contractor for USAF's Ballistic Missile Division now is expected this week.

Final details now to have been worked out last but not least, is a meeting between Aerospace Corp.'s board of directors and STL.

Board membership of Aerospace includes Victor Gardner who was USAF's assistant secretary for research and development since STL's predecessor Ramo-Woodbridge Corp. was created under USAF Gen. Paul Pennington, former commander of Air Defense Command and retired USAF Gen. James McCormack, former director of development for Air Force.

Gardner is understood to have taken a leading role in discussing the transfer of responsibilities from STL to Aerospace. "Effective date will be late 1991 if details were settled by then, is expected."

Ronald L. Colburn, who was under secretary of USAF from 1953 to 1955, who has been mentioned as a possible member of the board, and his name has been discussed in connection with the chairmanship.

Richard F. Thorne, who is about to

leave the job of associate administrator of National Aeronautics and Space Administration has declined to take the chairmanship of the corporation. He succeeded Gardner in the USAF research job.

Major Lewis, executive vice president of the American World Service, Inc., has been named to the board. He is a former Air Force lieutenant colonel and is under consideration for a board membership.

The corporation has been formed to permit BMD to invest its close ties with STL, which have been the subject of considerable criticism from Congress, into SLL is an independent subsidiary corporation of the Thompson Ramo-Woodbridge Corp. (TRW), May 7, 1971, STL will continue its association with Thompson Ramo-Woodbridge and is expected to assume a number of the research and development duties of the Ramo-Woodbridge Division.

Highlights of the new corporate structure and the role of the assignment appeared to have slipped by this week.

•**Board chairman** has been selected to make his first official visit to BMD's SLL complex this week. Appointment of board chairman has been completed. Selection of the board apparently was one of the most difficult aspects and was expected to have delayed considerably the implementation of the corporate plan.

•**Research** has been taking on other part in conjunction with BMD, in the preliminary and final experiments for the new corporation. Other personnel associated with the formation of the new organization include Air Research and Development Commanders Lt. Gen. Bernard A. Schriener, BMD Commander Maj Gen. Charles J. Roberts, and Col. Samuel B. Roberts of Air National Command, Ballistic Missile Division, which probably will create and

Ion Engine Contract

Hughes Aircraft Co. last week was awarded a \$900,000, one-year contract from National Aeronautics and Space Administration to develop and demonstrate a crystalline ion engine design about 100,000 lb. of thrust. If the engine is successful later models will be scaled up to 100,000 lb. of thrust and could be used with the 10-ton launch ship if nuclear power unit.

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CosmicRayExperiment To Involve 14 Nations

Washington—Office of Naval Research last week launched a \$200-ft. plane to explore cosmic rays in 1980. It's a study of photomultiplier emission to record cosmic ray phenomena at altitudes up to 114,000 ft.

Analysts at several facilities would provide data on interactions of cosmic rays with other particles, which could result in identification of new particles in space. Project scientists estimate that it is necessary to observe the conditions that are being reported 10 times as long to produce correct data.

Twelve two universities and research institutions in 14 countries were to make portions of the cosmic study over DND National Science Foundation sponsorship. Among them is the Polish Institute for Nuclear Research, Oxford as the University of Wisconsin, Washington University, University of Chicago, University of Tennessee, University of Rochester and the Naval Research Laboratory in the U.S.; Canadian National Research Council, Brookhaven Center of Physical Research, Wisconsin Institute, Israeli Cooperative, European Group of Japan, Tata Institute, India, University of Sydney, Australia, University of Bristol, England, University of Copenhagen, Denmark, Ecole Polytechnique, France, University of Hamburg, Germany, Universities of Bonn, Federal Milan and Torino in Italy, and University of Bonn, Switzerland.

The graduate period was to last from purchased from the 10th floor of a building near the Pentagon, after a two-hour 350-ton flight from the Research, Ga. launch site. The testing mechanism to separate the payload apparatus, four, pre-arranged means on schedule. Late in the week, Navy is testing the balloon with RSD aircraft as the system defined as a test in northwest path of altitudes varying from 114,000 ft. to 65,000 ft.

News Digest

Federal Aviation Agency's choice of a company to develop a Sea-View or traffic control radar transponder for small aircraft is expected to be announced next week. Approximately 20 aircraft manufacturers submitted proposals.

Aerojet-General Corp. lost a \$100,000 Navy contract for hybrid rocket research. Aerojet will continue a research effort already started by the Navy with hybrid rockets, which combine liquid oxidizers with solid fuels.



Fiat G.91T Trainer Makes First Flight

Prototype Fiat G.91T trainer makes seventh, made its first test flight. Fiat tested 42 tons and accomplished all test objectives. Fiat said. Ordered by Italian and West German air forces. G.91T was designed for schooling and pilot training (AVR Jan. 25, p. 151).



Federal Aviation Agency RB-57, one of two Lockheed bombers converted for high altitude flight studies, is the agency, was abandoned in flight last week, near Takoma, Md., when two control stabilizer controls jammed. Two crew members bailed out, landed without injury.

De Havilland Aircraft Co., Ltd., will take over the D11-121 short-haul jet transport project from the Aircraft Manufacturing Co. Ltd. group, which includes de Havilland, Hawker Aircraft and Taito Aircraft. Since the three are in different groups in the recently reorganized British aircraft industry, they have decided to transfer the entire D11-121 project to de Havilland Aircraft.

Aero-Martin F-4 Phantom II test vehicle was fired on a program of tactical tests from the Atlantic Missile Range last week in a flight series test. Decision second stage was caused by the engine on its short range flight.

Rafael Corp. of America was awarded a small task contract last week to determine the capability of radar and

other detection devices to pick out and identify hostile missile launches, in part of ARPA supported Project Peace or Pacific Range, Fairchild, Sup. rather study (AVR Jan. 11, p. 151).

Chase Vought F8U-2N crashed when it failed to get airborne following full-throttle catapult launch at Patuxent NAS last week. The fighter crashed into a USAF H-19 helicopter hovering nearby, and an ambulance and a fire truck lifting the nose.

North American Aviation X-15 rocket research aircraft completed last week, while undergoing major tests of the Rocket Motor 17,000 lb. thrust XLR-59 engine at Edwards AFB, Calif. The altitudes of the No. 1 aircraft due for flight test next month "deregulated" and the forward section with pilot Fred Corfield landed near Thermo about 78 ft. in the fire of the blast. Corfield was unhurt. Previous engines on the X-15 have been the 16,000 lb.-thrust XLR-11.5. The No. 7 aircraft now is under modification in preparation for utilization of the larger XLR-59 engine, and is scheduled for flight in September.

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Capital Management Fights Insurgents

Washington—Capital Asset's management last week looked out of the Capital Shareholders' Arms in its first attempt to thwart the employee-stockholder group from calling a special stockholders meeting to overturn the recent board of directors.

At the same time, the company's management was over a second go-round of lawsuits to its side by naming Cindia Y. Biland New York state's most harmful to the board of directors. Biland is the chairman of the Capital Defenders Holdings Protective Committee.

Meanwhile, the debt-ridden currency gained a third extension in the proceedings brought against it by Vickers Armstrongs and now has until June 27 to consider changes in the British manufacturing or a hardening act.

The management group opened its fight against the Capital Stockholders Association, expending some 2,000 copies of the company, with a letter asking stockholders "to withhold our judgment and sign nothing that will reflect our company in what we feel is an unwarranted, dishonest and expensive meeting." The campaign began solicitation of stockholders two weeks ago, calling for a special meeting to name a new board of directors.

The letter, which was signed by Capital's Board Chairman Thomas D. Natchez, Jr., and President David H. Baker, stated that the management "believes the calling of such a meeting would seriously hurt Capital." It promised a full statement later and concluded with "there will be ample time for you to decide what to do when you have all the facts."

Naming of Ballal to the board of directors brings the board to a total of 14 members and shifts the balance of power within the board strongly toward Baker and the present management. Prior to the appointment of Neebhalet months (AW No. 24 p. 16), the board consisted of 12 members generally split down the middle on the question of who should run the company.

At least one attempt was made to ouster Baker from the presidency by members of the board faction opposing the parent management. Another member of the faction earlier attempted to vote Charles Macchione into the board chairmanship in a move to scrap management's efforts. Both attempts failed in a small margin.

Release of power between the two hard factions was seldom settled, and the sharp split between the two often caused a deadlock on issues aimed at ending the years out of its financial

sight. However, in the past few weeks, the group opposing Baker has been in the minority, and the present management appears to be firmly entrenchment with the full backing of Norlands and members of the executive committee.

Marshall has been side-tracked. His use of the company has first been held with the company in legal counsel and has been removed from the executive committee although he remains a member of the board.

Both management and the nonpension-stockholder group have been in touch with Volker-Amstutz. How successful the stockholder-empire group has been in the subvention of private is still an unknown factor since the organization is prohibited by Securities and Exchange Commission regulations from disclosing such information. However, there is strong evidence that the group is not unhappy over the situation thus far.

The Capital Assets Delawarean Protective Committee, headed by Billford, made substantial progress in the initial stages of its organization. It promptly met with Capital's management, with the Bankers Trust Co.—trustee for the Delaware holders—such as Vickers-Armstrongs and with general counsel for both Vickers and the trustee for the note holders.

Copetti's management stressed the appointment of Ballard to the board as the way.

The final meeting of the year, at which we elected a board of directors took place April 20 in a few weeks ago. At that meeting, the (Cognitive) Stakeholder Association proved as confident and robust as it ever in opposition to the director whom we elected. Since that time Mr. Thomas D. Norrleis, Jr. has been elected a director and chairman of the board of directors and Mr. Gordon Billings has been elected a director and chairman of the Executive Committee of the 44th Convertible Unbonded Debentures of the company. We have elected a member of the board of directors and an executive committee.

It added

¹ Now, they [stockholders/analysts] are soliciting your funds and asking for a proxy to call a special meeting to replace the board. The replacements are to be nominated by the association, whose members own an average of less than 10 shares per member, and are as yet unnamed and unknown.

Meanwhile, the Capital shareholders officials view the letter as an expression of concern on the part of management over the progress the association was making in its move to take over control of the company. The group said it has

no intention of slowing down in its drive to overthrow the present board of directors and use official recognition to Aviation Week that no member of the group has intention to sit on the board or top management if they are successful in changing the management.

FAA Warns Airlines On Flights Near Cuba

Washington—The Federal Aviation Agency has ordered U. S. airlines to avoid turbulent flying in the area of Cuba as a result of Senate testimony on alleged Government conspiracy to crash U. S. aircraft in an accident.

State national Security. Subsequently, he lived the story from *Millions 1*. Workhouse, a Cuban national who served since 1961 as director of the Cuban Civil Aeronautics Administration. He was forced to leave Cuba early in 1960, shortly after the Castro regime came to power, because he was "Israeli in American." He said that the airplane was to give direct contributions in two or more installments and bring about a shift that could be essential to meet pressure on a full-scale demand of entrance from the part of a U.S. pilot. The

Whitcomb volunteered to appear before the subcommittee. His testimony was based on reports he had received from unidentified sources. He reported that there are "several well-known Communists" holding key positions in each of the four Cuban entities—Compania Cubana de Avionamiento "QA," Cuba Aerospacial, Empresa de Mantenimiento de Aviones and that the Cuban Civil Aeronautics Commission "also suffers the terrible effects of the Communist hold."

He said that Communists "have created terror and total disorganization" in the Congress and threaten air traffic control system.

As leaders of the alleged conspiracy, to create an accident? Whichever, named Lucenio Alves Rodrigues, president of the Air Traffic Controllers' and Cerezo Cepero, a controller at the Ilheus International Airport, both of whom he identified as Communists.

Witchamonee also identified as Communist the president of Au Pate Amie, J. Turner, and the president of Cuban Ashburn, Tito Elvordia.

HEILY HOOK of FAA Career C.H.I. program was product design tests for All American Engineering Co.'s testing center.

Transport 'Hook' Landings Demonstrated

By Harry Telle

Georgetown, Del.—First arrested boarding of a transport aircraft tried with a belly hook, were made at Sussex County Airport here by the Federal Aviation Agency. The landings were part of a project to study the feasibility of hook installations on transport aircraft.

The study contract, awarded to All American Engineering Co., Wilmington, Del., called for 20 assisted loadings with an FAA Copter C-131. The 20 loadings were completed, along with one failure to snag the mooring was precluded. The "win" was the first attempt before a demonstration and only after 16 previous successful engagements. Following the hook slip incident, four successful attempts were demonstrated.

Medigene Force

This observer, riding in the rear ward facing seats of the Conquest, experienced only slight deceleration forces in the aircraft rolled out 2,150 ft after engaging the E in nose position. Deceleration forces appeared comparable to a sudden application of reverse pitch thrust in a propeller aircraft and were uncomfortable, less severe than those experienced on an aircraft carrier land-

ing. The average speed on largescale the product was 98 lit./Aircraft weight, during the test was about 20,000 kg.

All American Engineering is attempting to interest the oil transport industry in its company's armoring gas now in operation at refineries, oil fields. Another company is the armoring gas business is the E. W. Bliss Co., Canton, Ohio.

The Wokingham concern designed the book for the two-engine Conquest and the instruments were made at the company's test facility here.

The starting gun, the company's Model 340 D motor spinner type, employs a loose fitting piston which is pulled through a tapered, fluid-filled tube to deactivate the circuit. The starting gun is designed to provide a constant moment of 1150 ft lbs, thus operating the deactivation over the

Head Modified

The hook employed on the FAA Contender is a modified version of the one designed for the Navy Douglas A1 aircraft. Modifications included extending the hook 18 in. to a length of about 5 ft. The hook is fitted to the underside of the fuselage and stows neatly tied to the tail of the aircraft. The hook is raised and held in the up position by hydraulic pressure and forced down upon release of pressure to compress air discharges. The weight of the entire hook assembly is 130 lb.

All American has designed a flat spring steel emergency arresting hook for the Convair F-106 fighter. The

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plants ever developed. Its simple, rugged design ensures easy maintenance and high operational reliability. Backed by Pratt & Whitney Aircraft's world-wide service, the JT12 is an engine conceived, designed and built for business use. It's one of the reasons why so many leading firms in the U. S., Canada and Europe have already ordered Lockheed Jetstars.



PRATT & WHITNEY AIRCRAFT
Littleton, Colorado
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load, a mounted load to the bulk of the lighter in front only, the hook point offers resistance to the movement. In an emergency situation, a released locking mechanism releases the hook point and the hook swings to the down position. The hook, upon returning the runway, is forced against the runway surface by means of the spring steel, facilitating engagement of the emergency jockey.

An installation of this spring steel hook, on the Gemini, would weigh 50 lb., according to All American.

The response, him dropped a water sprayer type mounting system for transport aircraft weighing between 100,000 and 200,000 lb. This system, Model 3060 1000, has never been built. How-

ever, All American has proposed installing that system for test purposes at the test site at Edwards. Charles V. Va. in connection with this proposal to the FAA, the company, has proposed the installation of one of its spring steel hooks on a Boeing KC-135 which the FAA is scheduled to receive as a test item from the Air Force.

The FAA while studying these latest proposals is having a leading group of engineers meet at its National Aviation Institute, Experimental Center at Atlantic City, N. J. The tests are of a pop-up system, triggered by the nose wheel to engage the main landing gear. Results of the tests, which would, can an leading gear configurations, have not been announced.

FAA Threatens to Suspend Pilots In Dispute Over Flight Inspectors

Washington—Federal Aviation Agency threatened airline pilots with suspension last week for refusing to allow FAA inspectors to conduct on-site inspections of jet transports from the jump seat behind the pilot.

FAA took the action after Eastern Air Lines pilots had forced cancellation of several flights because pilots refused to take off with an FAA inspector in the seat normally occupied by the third pilot, who flies in Eastern's DC-8 cockpit under supervision of the airline's chief pilot.

Eastern obtained a U. S. District Court temporary restraining order to prevent ALPA and its Market Executive Council in Miami to reveal information, which is said to be confidential flight inspection.

FAA Administrator E. A. Quast said last week that the "impunity challenge" by pilots refusing to admit to "routine" inspections. He announced that FAA had issued a special Civil Air Regulation providing that all current rules, available "... a seat on the right deck of each aircraft ..." for inspectors.

The special regulation also specifies that in active transport aircraft having more than one observer seat, the inspectors will sit in the seat directly behind the pilot.

ALPA and TAA appeared to be "intentionally ignoring civil into a legal push but between two private parties." The union and pilots welcome, proper inspection, but they object to having their members deployed. ALPA decried the pilot's action in refusing to fly the jet aircraft without the third pilot in the seat behind the pilot.

Quast said that pilots who refuse to submit to routine inspections would

be considered unfit to fly aircraft and would have their certificates suspended for 30 days. He said that the FAA is the Eastern despite the pilot of one DC-8, who cancelled his flight in refusing to fly, later submitted to an inspection.

Quast said the removal of the third pilot from the seat directly behind the captain to permit the seating of an FAA inspector would not impair the safety of the aircraft in flight. He said the DC-8 was certificated for a pilot and a copilot and that the agreement between ALPA and a company was their business and the agency was not an interested party.

Quast said the FAA conducts the routine inspections on a non-scheduled basis and checks about 1% of the scheduled flights made in six given periods. He added that the agency has a legal right to conduct these inspections and as far as he is concerned the inspector will sit in the most advantageous seat to conduct inspection.

A meeting was scheduled between FAA and ALPA officials to discuss the need of 1978. Quast said a week before ALPA withdrew the agency if it had taken on an action and as he said the members not to take off if the seat behind the pilot was occupied by an inspector.

Helicopter Carriers File Financial Reports

Washington—Trade in operating losses, and the industry's first year results filed with the Civil Aeronautics Board by Chicago Helicopter Airways, Los Angeles Airways and New York Airways.

First quarter financial results show that Chicago Helicopter Airways, oper-

ating a mixed fleet of three Bell 430 helicopters and seven Sikorski S-70s, had a better break-even average load on a narrow ton mile basis than either of the other helicopter airlines. Los Angeles Airways is operating a fleet of six Sikorski S-19s and New York Airways has the Vertol V-440s.

Based on reported revenue ton miles of 1987-1988, CHA has a break-even level of \$3.37 per revenue ton mile compared with LAA's \$5.15, or 48.72% against ton miles and NYA's \$8.45 based on 67,388 revenue ton miles. In the same time period, the Chicago carrier earned total ton mile revenues of \$4.79 including about 10% of \$1.

LAA produced a revenue rate of \$7.36 with ton miles of \$4.78 and NYA's earnings per revenue ton mile were \$11.57, including rebates of \$5.08.

Total direct operating per revenue ton mile, including flying operations direct maintenance and depreciation were \$4.14 for CHA, \$1.40 for LAA and \$6.63 for NYA. Total indirect expenses for the three carriers were \$2.74, \$2.55 and \$2.73, respectively.

A breakdown of direct operating expenses by type of equipment or an aircraft mile basis shows total direct expenses for CHA's 12 passenger S-19s of \$2.92. The passenger S-19s flown by LAA had expenses of \$1.08 and NYA's 14 passenger V-440s had a total direct operating expense of \$4.97 per aircraft mile. The figures include, combined flying operations and aircraft maintenance expenses of \$1.71 for the S-19s, 99 cents for the S-19s and \$1 for the V-440, based on total aircraft miles of 151,668, 153,604 and 171,873.

Direct maintenance rate for CHA's S-19s was 5.4¢ per mile compared with 4.4¢ for the S-19s and 4.4¢ for the NYA Vertol. Revenue passenger load factors suffered during the first quarter were 73.7% for the S-19s, 54.1% for the S-19s and 46.4% for the V-440.

Total revenue, ton miles recorded by Chicago Helicopter Airways increased 112.4% to 1987-1988 or the first quarter of this year compared with the same period of 1978. CHA's revenue ton miles increased 10% over the first quarter of 1978, while NYA's revenue ton miles increased 37.1% to 67,388.

CHA's annual revenue increased 35.8 cents to \$5.12 per revenue ton mile for the first quarter over the same period last year, while total operating expenses decreased by \$5.62 from a 1978 figure of \$10.15. In the same period, LAA sustained annual revenue of \$11.57, or 58.5¢ per revenue ton mile, but reported a 20-cent gain in total operating expenses of \$7.06 per ton mile. NYA's annual revenue decreased 37.7 cents in the period to \$1.53, while total operating expenses decreased \$5.24 to \$12.00 per revenue ton mile.



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The vast research and development facilities of Sealslug's main subsidiaries—Armstrong Whitworth Aircraft, G.E.C. and Sperry Gyroscope Co.—are constantly being used to improve the performance of the ship-to-air missile system. Already Sealslug is established as the most responsive weapon in its class. Several headed missiles have been fired with outstanding success from both land and ship-based installations. And, as the new branch of missile, nothing stands in the way of development of ship-to-air weapon systems in a highly specialized branch, calling for vast experience.

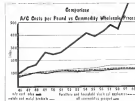
The know-how obtained by the three principal contractors guarantees the success of cross state formidable defensive weapons in the future.



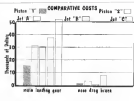
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AIRCRAFT COSTS per pound are compared in chart at left with wholesale prices of metals and metal products, and plastics and household electrical appliances. Chart at right shows comparative costs of different piston-engine and jet aircraft components.



TWA Scores Jet Airliner Parts Pricing

By David H. Hoffman

- Refusing to supply price information on parts, thereby forcing the airlines to replace items that should be repaired for maximum economy.
- Failing to keep adequate inventories in anticipation of future sales so that lead times on critical part orders now range from 75 to 180 days.
- Failing to make adjustments on available components without determining which item available would do the job for the lowest price.
- Neglecting to standardize parts that should be interchangeable on aircraft of the same make.
- Ignoring the reliability record of a

given component used and maintained in more than one airline. And that the airlines often have a troublemaker part in the field often is sold at a steep discount to people who buy or maintain airplanes and those discounts the necessity for costly design changes. TWA said.

Taken together, such shortcomings are hampering the efficient production of the jet transport. TWA's original estimate was that the Boeing 707 would return five times more in revenue than a medium piston-driven airliner while costing about twice as much.

But in actual practice, according to Deere, the target is costing about

Kansas City, Mo.—Jet aircraft parts prices are often excessive and arbitrary, leaving little advance to value or supply production costs. Trans World Airlines top management told representative of 50 suppliers and airlines here to the airlines, success shift their budgets, attention to increased aircraft and space vehicles, TWA's spokesmen emphasized the airlines, success increasing importance, in connection of components and most considerably better service from their vendors.

J. A. Sklar, director of technical purchasing for TWA, named the airlines, support companies that those many factors are present in testing the aircraft industry. "In the 2½- to 3½-yr. of a 95% customer" will find their loss of order for parts and supplies suddenly stopped.

Holding the spread of aircraft parts costs will free value added for investment in new jet transports and R&E. Mr. Deere, TWA's vice president for technical services also agreed the company for 152 representatives of the manufacturing and airline industry. Reduced material costs, which are common (6% of the airline's revenue) will make possible the low cost basis needed to bring air travel within reach of low income brackets. Then, in turn, will increase the demand for parts and supplies as current expansion efforts to accommodate what is currently a vast but untapped market. Deere predicted.

Specifically, TWA charged that prominent airlines, besides overpricing of basic value parts, at

TWA Inventory Breakdown		
	Before Feb. 12, 1961	After Feb. 12, 1961
Expendable items (\$4,800 type)		
Repair parts	\$ 12,575,400	\$ 12,482,480
Passenger service	207,000	318,100
Raw materials	1,279,500	1,467,967
	\$ 13,999,300	\$ 14,268,547
Replacable-Rope and rope (\$5,000 type)		
Inspection and power pack	\$ 18,217,000	\$ 27,838,880
Payroll	1,806,000	3,677,190
Rent	1,493,000	2,721,280
Accessories	14,278,900	35,855,580
	\$ 36,803,900	\$ 69,123,280
Miscellaneous		
Payroll (total)	\$ 7,215,100	\$ 5,689,100
	\$ 36,949,100	\$ 74,812,380
Actual value	376,418,680	332,137,500
For cost accounting (percentage to first investment)	21%	22%
First investment	197 aircraft	196 aircraft
	11 types	12 types

TRANS-CANADA AIR LINES ORDERS MORE VICKERS VANGUARDS



TRANS-CANADA AIR LINES has ordered three more Vanguards. This raises their total order to 24.

TCA President, Mr. Gordon McGregor said, "The most exhaustive studies by TCA's engineers have convinced me that the Vanguard will be the finest aircraft of its class in the 1960's, with exceptional passenger appeal and extremely low operating costs."

Mr. McGregor's confidence is well placed. The

Vanguard goes to TCA with all the engineering experience and more than 2,500,000 Vickers turbo-prop hours "built in" its design. It is the world's only aircraft generation turbo-prop engine.

Big, roomy and comfortable, the Vanguard is built to pace the jets. In fact, this four-engine turbo-prop can generally show a better "block time" on short to medium haul routes than comparable pure-jets—

and is far more economical and flexible. TCA intends to operate its Vanguards on medium range routes in North America and the West Indies. Each will carry 100 passengers in modern luxury, plus four and a half tons of freight.

The Vanguard's cargo capacity is another notable feature of this outstanding plane. Its two huge holds can accommodate up to ten tons of freight, so that

with only 30 passengers aboard, the Vanguard can still make a handsome profit as a freighter.

We congratulate Trans-Canada Air Lines on their choice of the Vanguard. Planned to produce high operating profits, this newest of the turbo-prop is the most advanced aircraft ever designed for economical operation. For further details contact Christopher Clarkson, 30 Rockefeller Plaza, New York 20, N. Y.

HERITAGE FROM THE WORLD LEADER IN JET-PROP AIRCRAFT...
POWERED BY FOUR ROLLS-ROYCE TYPE ENGINES

VANGUARD

VICKERS AIRCRAFT LTD. - WALTHAM, ENGLAND - VANGUARD CRAFT OF THE VICKERS GROUP

Airline Income & Expenses—1st Quarter, 1960

(IN DOLLARS)

	Passenger Revenue	✈ & Mail	Property ¹	Charter	Refuel/ Outlets	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNK								
American	64,515,949	5,441,579	7,841,399	64,495		74,599,728	75,490,454	-1,440,184
AA/BP	12,487,176	442,311	120,239	48,439		12,827,267	12,839,464	-684,643
Capital	97,101,993	562,416	150,114	3,442		97,864,418	98,490,920	-6,415,740
Continental	15,074,571	195,399	115,493	39,457		15,395,464	15,275,466	119,129
Delta	27,710,289	497,829	1,750,178	30,323		29,973,424	29,219,342	754,082
Eastern	58,840,737	1,795,174	2,158,435	152,739		62,891,480	63,418,449	-527,455
ET	17,434,389	519,354	1,659,319	148,844		19,741,549	19,958,419	-216,870
Northwest	8,468,673	148,763	372,977	2,814		9,294,460	10,416,207	-1,121,685
Northwest	17,816,541	410,364	273,811	42,617		18,436,844	19,194,444	-757,599
Trans World	21,132,393	1,715,461	3,447,455	491,919		41,279,447	42,703,345	-4,423,196
United	19,931,090	2,282,844	4,427,840	107,819		49,649,490	50,839,842	-4,194,061
Western	15,168,479	344,734	555,311	26,107		16,211,254	16,115,490	1,035,764
WESTERN LOCAL								
American	1,790,283	9,576	146,123			1,945,884	1,747,847	198,036
AA/BP	1,747,541	41,589	145,880			1,894,910	1,694,998	199,912
Continental & Delta	9,647,447	9,888	40,334	2,439		9,700,108	787,139	1,122,869
Delta	808,228	13,728	40,308			862,264	1,144,174	-281,831
Eastern	4,105,557	127,493	149,630	15,470		4,407,153	4,346,433	160,679
ET	591,410		14,441			605,851	541,964	63,886
Northwest	254,364	9,334	20,341	29,291		304,109	315,323	-11,214
Northwest	4,841,203	4,433	1,750,430			6,595,474	6,916,107	-320,633
Trans American Combined	67,147,113	8,709,599	12,184,849	1,769,899		89,657,459	86,347,115	3,310,344
Alaska	700,497	44,287	10,240	2,129		816,954	9,415,235	-384,783
Alaska	26,984,508	9,932,124	4,671,738	406,423		38,994,793	1,316,448	36,332
United	30,685,407	411,343	3,791,695	43,685		35,149,144	36,346,581	-1,197,437
United	16,254,728	2,130,487	2,150,237	116,817		24,632,274	24,317,114	315,160
Western	3,431,084	146,407	708,024	12,384		4,297,903	4,926,104	-628,199
Trans						1,196,136	1,196,136	0
Trans Continental	10,354,713	1,384,420	1,420,098	379,281		14,239,402	17,556,124	-3,326,722
United	2,815,423	107,648	75,854	37,449		3,036,334	3,779,600	-743,266
Western	1,244,764	6,434	70,891			1,322,089	1,344,585	-192,495
LOCAL SERVICE								
Albuquerque	1,441,863	51,479	105,411	1,544		1,600,310	2,431,389	-831,079
Albuquerque	1,718,248	10,744	10,240	14,847		1,743,039	1,741,732	1,307
Continental	1,016,846	18,289	27,311	6,134		1,068,579	1,237,171	-168,592
Continental	1,347,474	41,341	18,811	25,434		1,433,659	2,814,471	-1,380,812
Delta	297,201	14,494	14,234	1,364		327,290	1,091,203	-763,913
Delta	28,742,584	28,742,584	28,742,584	28,742,584		28,742,584	28,742,584	0
Eastern	5,695,199	68,756	144,818	40,497		5,949,270	6,449,434	-500,164
ET	1,212,410	36,919	70,919	9,157		1,329,405	2,300,270	-970,865
Northwest	2,299,229	22,542	28,441	1,624,919		2,351,131	2,351,131	0
Northwest	1,345,644	22,341	10,819	28,239		1,386,043	2,444,431	-1,058,388
Northwest	810,331	31,400	48,444	9,154		939,329	1,641,142	-701,813
Trans/Trans	1,424,407	37,442	73,419	19,193		1,554,461	1,449,494	104,967
West Coast	1,374,476	26,843	27,349	7,193		1,435,767	2,360,793	-925,026
KANABAS								
Alaska	584,361	5,484	11,719	28,991		620,465	1,110,126	-489,661
Alaska	1,400,830	6,477	301,712	493,417		2,100,235	2,364,548	-264,313
CARIBO LINES								
AIRCO			1,243,848	41,496		1,285,344	1,000,419	284,925
American Eastern Airlines			284,078	68,974		353,052	271,148	81,904
Florida	44,313	2,467,420	1,640,420			4,151,153	4,933,103	-781,950
Florida	25,615	1,919,499	87,191			1,952,305	1,471,192	481,113
Southwest & Western			1,243,848	41,496		1,285,344	1,000,419	284,925
MILWAUKEE LINES								
Chicago-Milwaukee	579,380	8,838	3,414			591,632	746,381	-154,749
Los Angeles-Milwaukee	46,979	16,199	49,408	1,779		113,365	144,023	-30,658
New York-Milwaukee	212,449	12,417	23,232	1,020		249,118	278,147	-28,029
ALASKA LINES								
Alaska Airlines	472,872	104,838	123,116	603,254		1,204,080	1,944,704	-740,624
Alaska Airlines	171,000	29,910	34,303	4,747		239,960	239,960	0
Continental	20,824	22,190	85,079	80,881		138,974	344,471	-205,497
Delta	10,122,444	240	250,847	279,123		10,643,654	279,123	1,414
Northwest	150,191	154,849	93,400	28,427		323,467	279,267	44,200
Northwest	1,022,321	103,144	191,720	12,409		1,317,594	1,999,791	-682,197
Trans-Alaska	26,117	26,117	26,117	26,117		26,117	26,117	0
West Alaska	143,219	143,219	24,369	24,369		167,588	167,588	0

¹ Not available. ² Property includes cost of freight charges & excess baggage revenues. ³ Western's operations suspended Mar. 18 to Apr. 2 because of strike. Compiled by Aviation Week from official reports to the Civil Aeronautics Board.

ROHR-BUILT JET PODS ON THE WING



The Convair 440 . . .
newest and fastest of America's
commercial jet airliners.

Rohr builds the complex, ready-to-install jet pod units (shown above) for the great new airliner. They represent but one of the many major aircraft assemblies that have built Rohr's reputation as the world's largest producer of components for flight.



Chula Vista and Riverside, California



PHOTO of hydroelectric installation at Fort LeOgny, France, was made by Capt. Ronald Yeager in an RF-101C.

Ground, Air Planning Accelerate RF-101C

McDONNELL RF-101C stands in aircraft during Ruff Flight Five reconnaissance exercise.



By David A. Asderon

Boulogne-sur-Mer, France—McDonnell RF-101C Voodoo reconnaissance light jet of the USAF's 66th Tactical Reconnaissance Wing, after scrambling to 12,000 ft on training mission will fly into the Iron Curtain.

That response speed is not indication of the well-planned, well rehearsed operations of the Wing, starting with the director of the general reconnaissance, working through the long chain of ground check, communications and photo interpretation and ending with the pilots who sort out the alerts.

Crack team down the 66th Wing completed its NATO's big general reconnaissance exercise, Ruff Flight Five held this year at French AFB Avenue 136 near the German village

AERONAUTICAL ENGINEERING



PHOTO of RF-101C from 66th Tactical Reconnaissance Wing starts from aircraft (left) makes sharp climbing turn after takeoff.



RETURNING from photo mission, Voodoo gets back after its landing direction, comes to a stop. Note the smoke on impact.

Scramble Rate

at the edge of the Black Forest. In spite of these operational problems, the 66th team left out on last general mission to Republic RF-941 units from the Royal Netherlands Air Force, and Canberra F4-7 jets of the Royal Air Force (AW) base 5 p. 70.

They were matched against the Dutch on medium range missions flown over a target area on a total track distance of about 110 miles. Post mission report was about 6:35. They called the RAF an "outstanding" mission of about 500 miles on total track distance and came within less than 100 miles of the Canberra units' score. The RAF team scored 4,512 points against the RF-101C's 4,490.

The 66th Tactical Reconnaissance Wing is made up of two medium squadrons, the 17th and 15th TAC



TECHNICIAN crew stand (center) inspecting the engine the Voodoo's engine is set



COUNTER-COUNTERMEASURES

... accentuate the positive ... eliminate the negative

Effective air defense requires high resolution for radar analysis and accurate tracking data for weapon control. Enemy jamming is intended to degrade resolution and accuracy, and saturate the data processing systems.

Bendix, as a prime supplier of the "radar eye" of air defense, is developing new radar and data processing techniques to permit weapon assignment and control in the face of such enemy jamming. A special simulation facility has been developed at the Bendix Systems Division to evaluate new techniques and concepts in real time. Both automatic and semi-

automatic methods are being tested. The purpose of the facility is to establish the optimum balance of men and machine functions.

This Air Force program involves system analysis, equipment evaluation, computer design, human factors, and operations research. The results of the investigations are being used as a basis for planning future Air Force programs. It is typical of advanced systems programs being carried out by the Bendix Systems Division. Better engineers and scientists interested in pioneering systems of the future are invited to join this growing team.

Bendix Systems Division

AIR FORCE DIVISION



CAMERA RAY is opened at left and technician cleans the lens for officers in the pilot leaves the cockpit to make his "hot" report and more detailed "household" report. At right, MAJ. Helder enables a film magazine and heads for camera action on the new



Recon Squadron based at Lane Air Base about 10 mi northwest of Reno, Texas, and the 13th and 14th TAC Recon Squadrons based at Plattsburg Air Base about 30 mi south-southeast of Storbach. Wing headquarters is at Lane.

Combined thrust of the RF-101C's part of Pratt & Whitney J57-P-13 turbojets with afterburners begins to approach the weight of the airplane, so that it loads performance is spectacular. Besides, the RF-101C is the same airplane as earlier photo reconnaissance versions, or the long-range fighter models, except that the C variants have been streamlined for low-level sweeps at very high speed.

Camera Array

The plane mounts an array of four cameras in the elongated, mounted nose and two cameras in a large fuselage belly bay. It is a one-man airplane, and the pilot "in one true bay," according to a wing officer. "We know a pilot should spend about two hours per day studying to fly this airplane and take pictures at minimum operational efficiency," he added.

Overhead views of the 66th Wing get proficiency flight checks twice a week under the critical eyes of four technical evaluation officers from Wing Headquarters. The evaluation pilots fly at

wingmen and check the combat crew through every phase of the assigned mission from flight planning to landing.

Locations where they were responsible for checking out the team that completed in Royal Flash Five. Capt. Hedges, 1st Lt. Wilfong and Wood in the medium-range category, and

Capt. Yagor, Hildbrand and Fostick in the long-range mission.

Royal Flash Missions

The six Wing pilots who completed in Royal Flash Five were chosen in a difficult round among combat crews, their photo and camera technicians,



ALL CAMERAS UNLOADED: the empty nose section of the McDonnell RF-101C is ready for unloading for the next mission.

Basic as bread... is the role of electronic instrumentation in human progress

And often, as close to home • Here, a food processor relies upon a Beckman oxygen analyzer to guarantee the freshness and flavor of orange juice. There, using ultracentrifuge, electrophoresis apparatus and chromatograph, immunochemists isolate ragweed allergens in the fight to control hay fever. Farther afield, a Beckman high temperature ceramic potentiometer helps launch and guide a missile. • Everywhere, in the pursuit of quality, the quest for a cure, the maintenance of leadership—Beckman is part of the plan. And wherever they are—in the laboratory, in the factory or in space—Beckman components, instruments and systems are basic. • They are the things on which Beckman builds its success... upon which users of Beckman products build theirs.



BECKMAN INSTRUMENTS, INC. ELECTRONIC COMPONENTS INSTRUMENTS • ANAL. RE. ANALYZERS, REAG. INSTR. FOR ENV. AND CONTROL
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ground eyes and transmitters per second which was the best the Wing had.

"During the assault," said one coalition pilot, "we sent them out over an airfield that had 96 airplanes on it. Then had to make one pass, photograph the field, and give us the exact hit report from visual reconnaissance on landing. One pilot estimated the field had 91 aircraft and another said 97."

"Another one of their targets was a railroad yard with 251 rail cars, one pilot reported. 251 cars and the other said there were 250. That's just one in a line of how good these pilots are."

Most of the professionals in the photo-reconnaissance business who attended the NATO course in observance re-emphasized again that the plane brought back to Capt. Ronald Yeager of the 6th Wing topped the rest in picture perfection. The shot was taken parallel to the face of a big dam at Samko-Capay, 15 mi. southeast of Cleveland, instead, Yeager was firing at 200 ft. and 500 ft. and took the picture with the left oblique nose camera.

The original print shows splashes in the water and tree-topside details with high clarity and contrast.

Yeager has said of the Wing pilots, has somewhat over 500 hr. on the RF-119C and knows the airplane and its systems. His average across the dam face was made a little slower than the usual flight speeds of the RF-119C: 360-420 or 450 kt., depending on environmental conditions. There was considerable low-level turbulence that day, and weather was threatening, holding up into late afternoon transfer status.

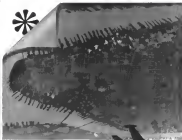
Yeager passed the dam at 402 ft. and got his shot in static balance.

Morning Briefings

Casual briefing for the day's mission was held in the morning at eight o'clock; plans were based on analysis for the day, the clouds, fields and on special conditions of ground value. Nothing was said about targets or day looking. It also provided an opportunity for competing teams to reach mutual understanding on a number of items which apparently were being interpreted two ways.

One morning the discussion included an argument on what may mean by the words "in the vicinity of" a definition of the center of the airfield—a check point to determine the accuracy of that specific kind of target area, and which direction is counter clockwise.

About the briefing, pilots assigned to the day's mission headed for targets after their airplanes and waited until 11:00 a.m.—one o'clock scheduled during the day, but delayed once until 11.



* What's Behind This?

a major advance in the state of infrared art
 by HIRSH-SINGER, INC.

At long last HIRSH is permitted to admit openly their relationship to the revolutionary "Machvision Stere." taken with IR equipment developed at HIRSH-SINGER. The map-like image was photographed under conditions of complete darkness. Amazingly clear, accurate and continuous data of the Machvision terrain resulted.

IR surveillance equipment which meets military requirements, is continuously being developed and improved at HIRSH-SINGER. Although RECONOFAX, the trade name applied to HIRSH IR equipment has been employed primarily in aircraft, it could be used in other vehicles such as satellites for scanning areas several hundred miles wide.

If you are interested in HIRSH's outstanding advances in the development of new concepts and systems for reconnaissance, surveillance, and infrared detection—military and industrial personnel with a need to know, contact HIRSH-SINGER, Dept. L.

ELECTRONIC RESEARCH AND DEVELOPMENT in the areas of:

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NEW MAGNETRON FOR RELIABLE FREQUENCY DIVERSITY RADAR

Frequency diversity and higher definition airborne radars are achievable with a new Litton Industries X-band hydroacoustically tunable Magnetron.

This tube is member in the growing family of hydroacoustically tuned pulsed Magnetrons we introduced two years ago for new equipment and retrofit frequency diversity requirements.

Designed the type L-3005, this Magnetron can be tuned at rates up to 100,000 megacycles per second over the frequency range of 8000 to 9600 megacycles. Pulse stability at peak power output as excess of 50 kilowatts is maintained while the tube is tuned at these extremely rapid rates.

The design and capability of this tube reflect our experience as a major supplier of thousands of hydroacoustically tuned CW Magnetrons for communications.

The ruggedized design permits applications of the L-3005 Magnetron where severe shock and vibration conditions may exist. The hydroacoustic is an integral part of the tube design, resulting in a smooth, positive tuning action. Provisions are made for the adjustment of the hydroacoustically controlled valve directly in the vacuum, ensuring nearly zero error, maximum reliability and ease of maintainability. Flexibility of system design is possible since the compact power supply and receiver system may be externally located.

Reliability, long life both in service and as the shell and maximum life power capability at any time are built-in features of this constantly improved tube.

We will gladly send you additional information, if you will write to Litton Industries, Electron Tube Division, Office A-14, 960 Industrial Road, San Carlos, California.



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CAPABILITY THAT CAN CHANGE YOUR PLANNING



GE Studies Caravelle Thrust Reverser Design

Wind tunnel tests of scale model of General Development Caravelle VII are being conducted to determine opening characteristics of GDS thrust reverser. Reverser designed to deliver 6,300 hp reverse thrust, reverser, becoming part of the after body of thrust-reverser. As at L3000, a flow through isolated engine and after body, enabling engineers to measure effects of the hot reverse thrust gases on design, compressor flow, reverse and loss.

As to whether to get their fuel system leading. This crew in the form of a standardized leading, as wiring leading to them in a scaled engine by one of the pilots. The timing started when the pilot got the envelope and continued during his planning of the mission.

He had a maximum of 40 sec to start the leading, plan his flight get into the engine and start to act. There's one more reason behind the 40th Warg's movements, started out in one of the three disposal area of this French fighter-bomber base.

Mission Activity

The instrument built out of the trailer, propel the light of steps and almost left into a landing Air Force crew one. As it started to pull out of the trailer area, white-covered awnings began a wide opening to the crew standing near the distant view road.

Technicians in the rearward looked up the air line from the ground power unit to the RP-101C and stood by the power supply.

The line or pulled into the reverse, the pilot climbed out, and checked the ladder held against the cockpit in the new shaft. Up the ladder after him assembled the segment, and started the steps reverse and pilot check while the pilot completed

the last few items on his takeoff checklist and started the engine. On signal the pilot started his roll and the tower standing in the front seat stopped his watch. It would start again when the plane began its roll down the runway.

Traffic control during the current are members of a positive, not only because of the number of airplanes per reporting, but also because the French air force was operating in F44 fighter-bomber outfit out of the base right through the current. Language problems were expected to give some trouble, and so it was decided for those and other reasons that training would come during portions of the mission between engine start and takeoff, and between the pass over the target at the end of the mission and the time the engine was out in the rearward.

Takeoff Timing

A judge in a pop stand, the RP-101C out to the end of the runway and parked well clear of the blue from the engine. The Yeosode rolled into position angled to the runway, while the pilot sat up the engine broke left and right alternately. When he slowly moved out to line up for takeoff held the brakes while the engine started to full power. Laid in the afterburner with a revving boom that echoed across the flight line, and started



PUMP PRIMERS ATTACH A SINGLE

Unique combination of advantages in GEOTON aircraft pumps

The GEOTON pump is a positive displacement type, delivering a well-lubricated amount of fluid in form of pressure in speed. It is a form of manual pump pump a single and output in basic design, (has only two moving parts). It is lightweight, reliable, accurate, economical performance at high altitudes and has low wear over a long service life. In addition, it is balanced and extremely quiet in operation.

Structure and operation of the GEOTON pump is relatively simple. The moving elements are the leather "liners" — inner and outer. Both are in the same direction and can be driven. The power element always has one less tooth than the outer and the "water seal" provides a chamber to move the fluid from the inlet or suction port to the discharge port. (See Figure 1).



Low relative speed and closely held dimensions between the two GEOTON elements allow high mechanical efficiency is maintained.

Slow opening of the chamber in a measure the longer tube and discharge ports results in avoidance of the sudden check, rapid pressure change and turbulence which, in other types of pumps, results in foaming and lowered efficiency. Thus, GEOTON pumps offer exceptionally good performance at high altitudes.

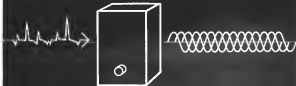
Valveless design prevents abrasion of mechanical troubles associated with the operating complexity and wear problems inherent in valve construction.

Applications for GEOTON aircraft pumps lie in the range of pressures up to 1000 psi. They are suitable for low pressure hydraulic and servo systems, hydraulic motors, actuators and booster service, pressure control systems in general and guided missiles, and similar applications.

Proven data is available and power source is verified. Write:

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FOR ANY ENVIRONMENT

New Hamilton Standard developments mark significant advances in static inverter performance, reliability

- Operating ambient from -55 to $+125^{\circ}\text{C}$
- Frequency regulation to ± 1 cps
- Voltage regulation to $\pm 0.67\%$
- Efficiencies greater than 88%
- Transient and overload protection

These characteristics represent major improvements in inverter performance—improved performance without sacrifice of reliability. In fact, Hamilton Standard has achieved significant reliability increases in all inverters now under development. This development program includes six or 40 models with extremely favorable power-to-weight ratios and outputs ranging from 15 va to 10 kva, single or polyphase, 60 or 400 cps, square or sine wave.

OTHER POWER CONVERSION EQUIPMENT, produced by Hamilton Standard, includes static conversion (AC-AC, DC-DC), static power supplies (AC-DC), transient suppressors, and thermoelectric converters.

NEW POWER CONVERSION PROJECTS now in advanced stages of study at Hamilton Standard are:

- Constant frequency input/variable frequency output
- Variable frequency input/constant frequency output
- Random variable input/controlled variable output
- Static inverter protection
- Controls for fuel cells

ADVANCED POWER SOURCE DEVELOPMENT is just one of the areas of electronics in which Hamilton Standard is working today. The company's experience also includes microelectronics, measuring, and electronic flight control systems for missiles and aircraft. These activities, plus the techniques developed in producing electronic controls for environmental conditioning systems, starters, turbojet and rocket fuel controls, propellers and ground support equipment, establish Hamilton Standard as a dependable source of widely diversified electronics capabilities.

WHATEVER YOUR REQUIREMENTS in power inversion are, Hamilton Standard can serve you well. For full details write Hamilton Standard Electronics Department, 70 Main Street, Braintree, Connecticut.



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SOME OF THE MANY FIELDS OF GROWTH AT HAMILTON STANDARD



ENVIRONMENTAL CONDITIONING SYSTEMS for space satellites and such advanced aircraft as the B-52, B-70 are important aspects of Hamilton Standard development.



EXCISE CONTROLS for over 20,000 aircraft gas turbines have been produced by Hamilton Standard. The company also manufactures such machines as advanced rocket engines.



GROUND SUPPORT EQUIPMENT provides Hamilton Standard is presently producing a wide range of GSE for both military and air transport—also special tools for complete systems.



Helicopter Turret Uses Remote Control

Lightweight turret system for helicopters permits remote control for external armament or battlefield surveillance television camera. Unit shown here employs an M69 7.62 mm machine gun. System was developed by General Electric's Visual Production Section, under contract from U. S. Army Ordnance. Cockpit control is handled like a pistol.

has taken off. Turning began again at first instant.

Power of the Voodoo was most apparent to observers at the controls, who were introduced to one such a large, complex, airborne and climbing struggle. In the time it had reached the end point of the maneuver. Normal operational maneuvers of the Republic RH-53's flows during the exercise took most of the service, and then pilots kept the plane on the deck and straight out of the field before starting the climbing turns to maximum altitude for their low level sweep.

But the Voodoos were climbing for altitude in tight turns right off the runway, and on one occasion miraculously came within feet of a major highway as a result. A Voodoo was turning left out of the field and climbing sharply when a Thunderbolt from Second AFAP swooped over the field low and fast in his climbing pass at the end of a runway. He was supposed to report on aircraft on and down 1,500 ft., and some observers had not report and came in at about 300 ft., turning above the runway to the left of the line was with.

Near-Miss

The exercise resumed just above the dispersal area for Second AFAP units, and emphasized the need for careful reporting in an future recovery. Moments later, he and another Voodoo's pilot reported in and landed across the field in a hovering highspeed run followed by an abrupt action roll.

Ground crew stood by, waiting for his signal to duck into position and remove the camera magazine. At the head of the ground markings stood a traffic director, signaling the Voodoo pilot into position. Left of the airplane stood the crew chief holding the boarding ladder, and in semi-circle left and right, waded groups of mechanics.

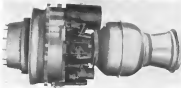
Camera open, the Voodoo turned to avoid the landmark lifted his left hand with two fingers extended, going the ground crew the number and position of the camera which had been used. Slowly the plane rolled to position and visual a moment. Thus the tower gave the start time signal and simultaneously the traffic controller signaled for engine cutoff and the technician made a dash for the airplane.

Film Removed

They opened quick-release fasteners, lifted the safe hatches of the camera compartments and went to work on the magazines. In a matter of a few seconds one crewman after another made a dash across the concrete pavement floor, carrying a heavy film magazine to the trailer for developing and processing.

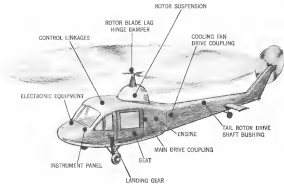
The pilot scrambled out and down the ladder to start his "hot report" and within a few minutes his visual reconnaissance was being watched in the data furnished by the set negatives inside the processing trailer. Later, not only a few minutes later, there would be time for a more detailed report, the "immediate report" which would include a thorough analysis of target pictures and a complete report on their characteristics.

In the meantime, a ground position marked with a stencil saying, "Air Power Starts with Ground Power," toward a deck up to the front which of the Voodoo and, after the pilot had been made, heated the plane out of the



Continental Develops 500-hp. Turboshaft Engine

Continental Aviation & Engineering Corp. is developing a 500-hp. turboshaft engine designated Model 514, presently for rotary wing applications (including a shown above). Engine weighs 210 lb. and has a 4,000 rpm output shaft. Also under development is the Model 517-A, a 2,100 rpm turboshaft engine; flight test is set for next April.



critical points for vibration/shock/noise control

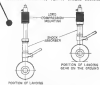
Improved flight characteristics, less noise and increased service life are major design objectives of helicopter engineers. Lord offers maximum assurance through advanced vibration/shock/noise control techniques and superior materials.

At critical points, Lord elastomer mountings combat the undesirable effects of engine vibration, rotor disturbances, airframe, landing shocks, operational noise, shaft misalignment and blade fluttering.

Close teamwork between helicopter engineers and Lord results in vital "breakthrough" in cost, size, weight or service life. For example, an elastomer rotor blade hinge damper provides improved performance with substantial savings in cost and weight.

Unique Lord capabilities in vibration/shock/noise control to ameliorate poor helicopter, VECOL, STOL or convertible project. Lord experience plus modern facilities for research, custom engineering, production, and testing will assure an optimum solution. Contact your nearest Lord Field Engineering Office or the Home Office, Erie, Pa.

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The low temperature flexibility, air resistance and excellent damping properties of Lord EPM elastomers are utilized in new landing gear spring ATR compressors storing elastic peak energy in landings, their pre-bias landing gear and bearings during ground type takeoffs.

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Meet the specialists of space.....

NEVER in history have the talents of so many scientific and technical specialists been combined in order to achieve a single definable goal: exploration of space. Proof is provided by Honeywell. For at Honeywell alone, analysis shows that scientists and engineers assigned to space projects represent almost every division of the physical and chemical sciences. To demonstrate the range of skills required in the design, launching, propulsion and guidance of space vehicles, Honeywell's Specialists of Space—from astrodynamics to sociologists and theoretical physicists—are catalogued on the inside pages.

Honeywell

 *Military Products Group*



e goal: supremacy in space



Illustrated on the diagram are the professional specialists represented by one or more men at Honeywell who are applying their training and skills to space exploration projects. Their knowledge and creativity, added to the company's demonstrated capability as an experienced supplier of sophisticated military systems, have made it possible for Honeywell to participate importantly in major United States space projects. Among them:

PROJECT MERCURY: NASA contracts include to provide stabilization and control system for the Mercury man-in-space capsule; inertial guidance systems for use in Centaur, the first U.S. high-speed space vehicle, and a basic control and guidance system for Scout, the first booster vehicle for space research.

SPACE CABIN SIMULATOR: Honeywell has delivered to the Air Force's School of Aerospace Medicine a device for simulating exactly the conditions under which two men would be required to function in space for ten or even as long as 30 days.

DYNAMIC ANALYZER: Work is in progress on a device that will test systems and their components on earth under most of the conditions and phenomena encountered in space. The Dynamic Analyzer will be delivered to the Air Force's Wright Air Development Center.

Honeywell capability is demonstrated also by work closely related to space exploration. Among these projects are ASROC, Thor, Atlas, Titan, Minuteman, Bomarc, Palomares, and a number of others that involve application of advanced technological concepts.

If you would like further information about Honeywell's competence in helping to solve space-age problems, write to Honeywell, Military Products Group, Minneapolis & Montreal. In Canada, write Honeywell Controls Limited, Warden Road Ave., Leaside, Toronto 17, Ontario.

Honeywell

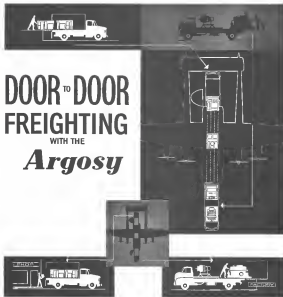
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PROCESS ENGINEER PRODUCTION ENGINEER PROJECT ENGINEER PSYCHOLOGIST RELIABILITY ENGINEER SOCIOLOGIST SOLID STATE PHYSICIST STRUCTURAL ENGINEER SYSTEM ANALYST THEORETICAL PHYSICIST THERMO DYNAMICIST TRANSDUCER ENGINEER



DOOR TO DOOR FREIGHTING WITH THE *Argosy*

The revolutionary Rolamat-Argosy system of unitized loading

One pallet, one winch—one streamlined operation door-to-door. That's the revolutionary air freight system with the Rolamat-Argosy. Small pallets are built up on the pallet, the unitized load rolled onto a truck and straight from the truck into the Argosy. Pallets can be linked together to take heavy bulky freight, such as machinery. No packaging is needed. Loads up to 150 tons, less than 6 ft 6 in. high and 8 ft 6 in. wide, can be slid easily into the Argosy's 47 ft. long freighthold.

A complete turnaround at the airport takes only 30 minutes, including refueling. Off-loading is just as easy. The cargo is rolled onto the tarmac backed up at both ends of the fuselage. An aerial handling technique is required—lifting trucks and cranes can thus be completely dispensed with. Rolamat saves time, saves trouble, saves money, saves labour, saves warehouse space. Yes sir, things really move with the Rolamat-Argosy system of unitized freight handling!

Designed to bring the cost of air freight down to earth

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equipment and turned it to position for the next shot.

Normal in-out of camera in the RF-101C includes a group of four mounted forward in the specially built foot rest section and two mounted in a large fuselage compartment. The farward four are:

- **New camera**, shooting forward and slightly downward from the forward Camera is a Fairchild Camera & Instrument Corp. KA-12 with a 12 in. F/4 lens, and a maximum exposure time of 1/600 sec. Film magazine is built by General Electric.

- **Vertical camera**, mounted to shoot directly downward. Also a Fairchild design this camera is a KA-2 type with a 6 in. F/8.3 lens with a maximum exposure time of 1/600 sec. Magazine is made by Chicago Speed Industries.

- **Two oblique cameras**, both type KA-2 with 6 in. F/8.3 lenses, and maximum exposure time of 1/600 sec. Magazine is also made by Fairchild.

Photo Coverage

Both the oblique cameras combined with the vertical give a horizon to horizon coverage when the plane is flying straight and level.

Cameras mounted in the belly are primarily intended to photograph large target areas from high altitude, rather than concentrating on individual targets in low-level runs. The two belly cameras are Fairchild KA-1 type, with 16 in. F/8 lenses, and a maximum exposure time of 1/700 sec. Working together they cover a 52-deg. included angle, cover, and provide the total 60% overlap between adjacent frames to furnish stereo pairs of prints for photo-interpretation.

All the cameras are equipped with automatic control gear which can be preset for the type of lens and film, and which leave the pilot free to worry about all the other things he has to do in the cockpit. But if the system malfunctions or if for some reason the pilot wants to shoot manually, the control system has the provision also.

Viewfinder Details

The viewfinder includes a viewfinder for the pilot, which gives him a direct visual presentation of the cockpit mount where a panoramic search-mount. The finder gives four fields of view: vertical at 30 deg. and at 60 deg. forward, measured from the vertical, with an included angle of view of 30 deg., and a wideangle view of 35 deg. included angle, extending from 5 deg. aft to 30 deg. forward measured from the vertical.

Feed into the section is an automatic exposure control system which works like the standard type of photo-electric exposure meter except that it tracks area, contrast and target size con-

plex. This unit has to be able to recognize camera settings in flight to recognize fast changing light conditions, and therefore uses a double-exposure system to measure adjusted light in two areas. As the plane flies over a target area, any difference in the light intensity reflected is both "even" as detected and amplified to change the camera settings as the light changes.

Final optimization is a master photo-recognition system is a method for identifying target motion. During low-level, high-speed sweeps an accurate or check data, the exposure times determined by the light meter system are long, and consequently the image of the target would be blurred. There are two ways of eliminating this: one is the camera or move the film.

Both big vertical cameras in the Vandenberg's fuselage are rigidly together and "panned" with the direction of flight of the airplane to eliminate motion of the target.

For the smaller cameras there are

slang system compensating system built into the film magazines which detects at least data from the so-called V/LH speed-spool/make ratio—and use that ratio to adjust the speed of the film through the magazine. As an example a film being exposed in a vertical camera during a 400-ft run at 900 ft. altitude, would be slowed through the magazine at about 16 in. per sec.

Systems Engineering

Systems engineering on the camera controls was done by the Alcoa R. D. West Laboratories, and much of the control gear was built by them. Major contribution to the overall mission assistance system of the RF-101C was made by Chicago Aerial Industries, which designed and built the image vision compensating system, and by the Bell Just Scientific Instrument Co. and Thome Manufacturing Co.

In spite of the complexity and sensitivity of the photo gear in the RF-



Testing Harness Checks Out F-105D Circuits

Remble Aviation engineers can check out 1,600 electrical circuits in the F-105D using the specially developed testing harness. Prefabricated bridge-like finger braces a battery of switches about each switch circuit has more than 170 sq. in. of wiring.

THEY RELY ON RADIATION

for missile range
instrumentation

In 1958, the Air Force called for a major advance in missile range instrumentation. The Advanced Missile Range The requirements, long-range instrument tracking of missiles in flight.

But even so, the challenge was what was that a solid new concept in range instrumentation. The heart of the instrumentation system was a different electronic tracking technology advance. The system's job was to keep track of missiles, reducing the number of proposed down-range instrument stations from four to three.

Satisfactorily meeting Air Force requirements, these advances have led to developments in precision experimental data from Vespene, Pioneer, Explorer, and Titan.

One of the instruments were delivered to the Pacific Missile Range to meet an accelerated launching schedule.

RADIATION is a leader in space electronics. The Company has designed, developed and produced complete systems and commercial air systems for NASA, AFPA, USAF, the Air Force, Army and Navy. But also designed and built the systems at Keesler Field, Houston, and elsewhere in the Mississippi valley for the Titan carrier vehicle project. The Titan XM instrument is another product of Radiation.

If you'd like more information about us, write for our latest capabilities report. Address: Radiation Incorporated, Dept. RM-1, Melbourne, Florida.

Business Offices are in Melbourne and Orlando. Branches/Offices in New York and Palo Alto, California.



1963, there were no cases of cancer mentioned during one of the Royal Thai Five numbers.

The fuselage would also match the wing, which never shared a name. The only trouble experienced by the Wing was that the fuselage had oxygen tubes installed and the tubes were crimping inside the wing. This meant that a Viscose made two lead rings and then went on for a few days.

At the end of the engine, when some machine stations were planned to check out equipment, the Wing received the mission and provided the place until new tubes were flown in.

Solid Lubricants Have High Load Capacities

General Electric will produce a series of new solid lubricants that are said to have 25 times the load-bearing capacity of pure molybdenum disulfide. Improved load-bearing capacity is obtained by adding approximately 10% by weight of various organophosphorus to molybdenum disulfide and organophosphorus lubricants. Most effective solid lubricants investigated to date are the sulfides of carbon, lead, molybdenum, phosphorus, silver and titanium.

Fire-Fighting Truck Uses Turbojet Engine

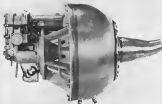
London-Norfolk Firefighting truck demonstrated at National Gas Turbine Establishment, Prestwick, England on May 24 uses a gas turbine to generate steam gas which generates the fire. The turbine is fitted with a heat exchanger and water is injected into the exhaust gases, generating the supply of steam gas.

Gas turbine is a standard British-Sulzer Viper turbojet mounted on a fire truck. The turbine has an air flow of 352 lb/sec and water at the rate of 14 lb/sec is fed into the engine by an electric turbo-compressor pump supplied from the engine compressor.

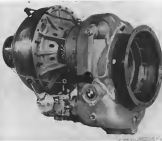
Corresponding volume flow to the fire zone is 50,000 to 60,000 ft³ of air gas at 120°C containing less than 5% by volume of oxygen. Output temperature of the effluent is governed by the need to deliver the gas through flexible piping.

Test gas supplies of the order, according to the British Fire Research Station, Birmingham, would provide a much more efficient firefighting medium than water in cases of very large fires which, although subsequent, account for the great proportion of total fire damage.

The turbojet would also reduce water damage.



GERMAN BMW 6025 turbojet thrust is about 79 lb. but can be used to 95 lb.



BMW 6022 gas turbine has been operated to 65 hp, at 45,000 rpm, under full load.

BMW Jet Develops 79 lb. Thrust

Munich, Germany—New BMW 6025 small gas turbine developed by BMW Turbomachines GmbH, Munich-Alach, is based on the company's BMW 6060 portable gas turbine powerplant introduced last year.

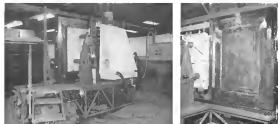
The 5825 has a dry weight of 77 lb. Takeoff thrust is approximately 79 lb. which, without any change in basic engine weight and dimensions, will be increased to about 95 lb.

The engine is fitted with an electric starter and operates on any standard fuel, but for economy and safety fuel

use of light fuel or diesel oil is recommended. Fuel also is used for lubrication. Prototype of the BMW 5825 was shown for the first time at the Hannover air show.

Rating of the BMW 6027 gas turbine has been increased from 55 hp to 65 hp at 45,000 rpm under full load. Output shaft rpm of the 6027 can be reduced from 11,000 to 3,000 rpm by gearing.

The engine can be started with a hand crank or electric starter. Overall length is 30 in., diameter is 27 in.



Stainless steel panel is held in an upright envelope in chill position (left) after leaving heat treated at 6000F between electrochemically controlled levels of radiant quartz lamps at Northrop Corp.'s Space Division. This photo (right) shows the heat-treated panel in its heating envelope in the lead radiant station on Northrop's Nucleonic machine.

Northrop Automates Brazing of Steel Honeycomb



Stacks of radiant quartz lamps (left) can be energized and controlled individually for heating vision panel shapes and sizes. Servicing, cassette control is production and temporary control center is Nucleonic system. Programmers (right) use a laser-temperature plot to provide automatic temperature control. USAF awarded Northrop a \$946,447 contract to adapt process to manufacture of advanced aircraft and space vehicles. Process now eventually replaces panel 3 in 12 for furnace brazing methods.



Northrop has been applied to titanium alloy and is adaptable to metals in the columbium and niobium groups. Northrop will

PRODUCTION BRIEFING

Phelps Dunham of Teco, Inc., has begun operation in a recently completed facility manufacturing the modified and turn fitted "Mesa" Modular Chair designed for business, private and commercial aircraft. These such as baggage containers, variable electronic shipping containers and other industrial and commercial products will be integrated into a product line in the Phelps Dunham.

Solar energy converters for the National Aeronautics and Space Administration's forthcoming lunar probe with one-third greater efficiency than those used in previous space probes will be fabricated by Helixone Electronics Corp.'s Semiconductor Division under a \$446,000 contract with California Institute of Technology Jet Propulsion Laboratory. Contract calls for 12 panels amounting to a total of 18,000 square inches with a light-to-energy conversion efficiency of 12%. Each solar panel will have a power output of 95 watts.

GenCorp Division of Underwood Corp. has received \$1 million in aerospace electronics and component contracts during the first four months of its current fiscal year. This compares with a \$5.5 million total volume for the major FY 1969. Current contracts, including research, development and fabrication for Project Mercury, the Air Force, Republic Aviation, Republic, Lockheed and the Navy, cover ground instrumentation systems, electronic components, electronic measuring equipment, data link and data processing systems, timing equipment, aircraft instrumentation and radar safety systems.

A thermocouple switch, located in the turbine exhaust stream and providing for automatic shutdown in the event of turbine or turbo-prop engine flameout, was installed in the Allentown Phoenix line of engine controls. Switch streams open at normal turbine exhaust temperatures within a range of 1,000F to 400F but of temperature drops suddenly below about 400 F, the circuit automatically closes, cutting in ignitors. Automatic reopening of the circuit is provided once ignition has been accomplished. Switch provides the same reset capability in continuous ignition but eliminates the expense and operational problems associated with the latter, according to Allentown Mfg. Division, of Garrett Corp., engine products.

U. S. Seivier Corp., Los Angeles, will automate photo control systems for the Genesee AG-1 observation aircraft under \$150,000 contract. The photo-control device permit mapping without pilot operation.



AIR FORCE RECRUITERS PUT CESSNA U-3A SUPPORT PROGRAM TO THE TEST. These men at a small university drive, two Air Force recruits prepare for take-off—only to find that their heavy, front overhang is not so easy to get out. Cause of action: Recruits the newly Cessna U-3A (U-3A, support) for a new U-3A, to be retired by 1968. A single drive. Made possible by a nationwide off-the-shelf support program growing out of Cessna's support of the U-3A's commercial counterpart, Model 310, and covered by Cessna to do for the Air Force what it would find problems to do itself.



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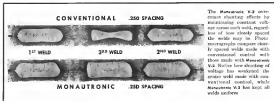
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The **Monautronic V-2** automatically compares actual voltage across the weld with constant voltage, and adjusts current accordingly to maintain voltage—and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic V-2** embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact **THE BUDD COMPANY**, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.



The **Monautronic V-2** minimizes spatter effects by maintaining constant voltage across each weld, regardless of how closely spaced the welds may be. Photo micrographs compare closely spaced welds made with conventional control with those made with **Monautronic V-2**. Notice how spatter of voltage has weakened the center weld made with conventional control, while **Monautronic V-2** has kept all welds uniform.

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SPACE TECHNOLOGY

Reflectors Cut Solar Power Unit Weight

Problem: Combining a lightweight solar concentrator and photovoltaic cells, a space power system which can develop the same wattage at 0.7 the weight of a conventional solar panel has been developed by Electro-Optical Systems Inc.

The straightforward system uses a reflective conductive silicon cell and the EOS-developed concentrator. Since it refracts an intense sunbeaming refraction of known techniques rather than its breakthrough, hardware would be available by the first flight date, which is projected for June 1961.

System is being developed under contract from Wright Air Development Division. Although EOS did much early work and engineering in the early EDS design approach, accepts the system's inherent efficiency of individual solar cells when they work at higher temperatures but obtain a higher total power output using the reflector than a panel of the same size without reflector could produce. Thus, while individual cells are working less efficiently, they furnish a greater total power from the higher illumination level, reducing a system which is more efficient in terms of watts per square meter of panel area.

Cell Efficiency
For its prototype system, EOS will use silicon cells which are about 12% efficient at room temperatures but drop to less than 9% at the 110F temperature level where the photovoltaic concentrator operates. During system development, EOS expects more efficient silicon cells will become available. Although several concentrator shapes are capable of keeping the higher level of illumination spread almost evenly over panel surface to maximize concentrations, EOS is developing its first prototype into one that plate reflectors in concentration, which are fabricated of aluminum but mounted on light frames. These can be folded for launch and spring opened to the desired position once the vehicle has reached orbit, and will be read on an eight-light system.

Heat Rejection Problem

While simple and reliable solar cell power system requires heat to adjust heat rejection problem. The concentrator approximates the situation since while raising illumination level it also increases heating effect. The normal ratio constant of 1:400, in an which appears at earth orbit distances from the sun. For prototype and early systems,

EOS will use lighter concentrator coatings on adjoining surfaces in one approach to heat rejection.

A second approach will have spectrally selective filter coatings and on silicon cells to reflect in such a possible of the infrared and ultraviolet radiation spectra which contribute nothing to power output but increase heat inputs. Filters are designed for space environment rather than earth, where atmospheric attenuation significantly changes radiation characteristics.

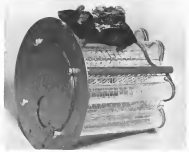
Another solar cell problem is high energy proton radiation encountered in the Van Allen belt which can put an unprotected solar panel out of commission in a week or less. Primary damage from this radiation is alteration in the structure of the crystal lattice structure of solar cells, cutting off electron flow and power output. Radiation also causes a degree of spattering on the cells. A

30 mil thick glass plate will be used in early flight system as protection against this radiation.

First refinements in the flight system will involve different concentrator shapes, after which better filters will be sought. Finally, better materials for the cells should be developed.

Although flat glass reflector-concentrator is easiest to fabricate, when configurations can obtain substantial gain in system performance in combination with EOS design techniques, such as a parabolic cone shape. However, the key elements in concentrators are to get maximum rigidity, maintain highly critical reflecting surface shape tolerances, and light weight.

EOS reflectors consist of a reflective coating, a glass, and the sun support. The company has developed a proprietary fabrication technique for these, which allows a few mils thick and



Radio-Equipped Mouse Atop Space Cage

Backup for mice to be studied in space-based studies was dropped and built at USAF School of Avionics Medicine, Brooks AFB, Tex. After the backup, which can sustain how many as type for three days into flight, one of the subjects and its tech carrying a miniature radio transmitter weighing 33 grams. A receiver battery, about the size of a short battery supply power. Range of the transmitter is approximately three feet and it sends the mouse's location periodically from the owner's body to the subject's radiofrequency system. The special case reduces the subject's movement and prevents signs due to breathing during flight of. Cage also contains oxygen monitoring equipment, carbon dioxide and water absorption units and a food supply.

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formed to the required shape, after which the expanding structural material is stretched or applied.

Starts are made of aluminum, hard brass and nickel, and spinning, stretch forming, electro forming and audio forming are used. Supporting materials include plaster, which are bonded into place and bonded. Control system is actuating shape of the film while support is being stretched.

High reflective coating is vacuum deposited aluminum.

A natural characteristic of silver cells is a decrease in efficiency with increase in temperature. In servicing new cell materials, RDS looks closely at the shape of the curve representing efficiency decrease. Comparison also indicates that efficiency at elevated temperature is a very important criteria when choice tubes are made, rather than performance at room temperature.

Two cell materials being developed are gallium arsenide and cadmium telluride. Production cells of these materials are available now which operate at 14 to 44 efficiencies. However, when two cells have been made which work at 44 efficiency, and the shape of the performance curve shows them to be more superior to others at temperatures above about 175°C, it is expected to be those in five years before this quality is obtainable in production cells.

World Astronautics Academy Planned

International Academy of Astronautics will be formed as a part of the International Astronautical Federation and will be formed for the first time since by the French and Pioneer Cosmo Club Foundation.

The academy will be set up to advise the president of the International Astronautical Federation when requested to hold scientific meetings and make scientific studies and reports to publish an international technical publication on astronautics and to award medals and prizes to further astronautics progress. The French government has agreed to provide quarters for the academy in Paris at no charge. The academy is expected to be formed in August at the Stockholm meeting of the International Astronautical Federation.

Goodrich-High Voltage To Build Ion Engine

Goodrich-High Voltage Associates, Inc., Burlington, Mass., will develop and fabricate a demonstration type space propulsion engine utilizing an ion type ion source. The ion thrust engine will be developed for Wright Air Development Division.

Schlieren System Set for Mercury Tests

Northrup, Calif.—Multiple slit, sharp-focusing schlieren system is set during final tests now in progress at McDonnell Aircraft Co.'s plant and tunnel where tests are made now on Project Mercury space capsules.

An edge of a multiple slit single slit system is that it can be used in a transverse test section having perforated walls for boundary layer bleed according to Northrup Corp.'s Northrup Division, developer of the system. McDonnell's facility has a schlieren range from the transverse region to Mach 5 and the boundary layer bleed walls of the operating transverse section are composed of 4.625-in. thick steel with 0.175-in. diameter holes, giving the walls a 25% porosity.

In addition to the observation camera in the boundary layer bleed walls, the entire walls of the test section have long wide window supports for up to 15-in. x 11-in. window panes. Northrup's schlieren system can be shifted for complete coverage of the window area over 11 in. x 51 in. range.

Suitable for use in both the super sonic and perforated wall transverse sections, the system in sharp-focusing optics plus a camera one foot stage gives the results of the test section type. The field of view at the tunnel entrance is 18 in. in diameter and is five ft. in length or full of observation at the edges of the photographs.

Working magnification range is between 70- to 100- and 2- to 3- of angular deflection with a high sensitivity limit of 5 arc. sec.

Because of problems encountered in obtaining a first footing for this system based on the site selected by McDonnell, the 7,000-lb. schlieren system is suspended from the tunnel overhead crane rails and is isolated from building vibration by integral coil springs.

The massive structure is actuated by hydraulic applied adjustment of the light source and camera assembly. Mounting on the overhead crane rails also permits the entire system to rotate in alignment with the tunnel building.

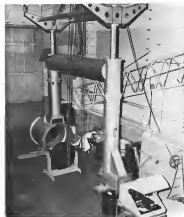
Operational requirements met by Northrup for the McDonnell tunnel are as follows:

- Shift from a 10-mm. f/8.0 lens camera to a 16-mm. f/8.0 lens camera can be accomplished in one second. During a 10-sec. to 120-sec. duration test run, cameras can be shifted and independently actuated remotely from the tunnel main console.

- Relocation of the system to an alternate test section can be done within the 18-min. interval between test runs while the blowdown tanks are recharged. During this time interval, the



STROBE LAMP and reflector (above) are shown through the multiple slit screen photo. Below schlieren system is shown in assembly and checked before shipment to McDonnell.



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station frame for monitoring and film recording over the entire panel test section span can be accomplished plus relocation of the system to an alternate system, as well as complete translation slide to either section plus adjustment and retuning of camera.

A continuous closed-circuit television system is incorporated for continuous monitoring during the tests, measurements and recording by either of the two cameras. The larger 70-mm. camera has an exposure rate of one to five frames per second while the 16-mm. exposure rate is from 10 to 100 frames per second. Light sources in a zero flash rate strobe light with modified housing. One flash frame is provided while either of the cameras is photographing

and 20 flashes per second are provided for the TV camera camera. A gainst current microphones the 10 per second flash at each frame is exposed by the Helium camera. While photographing with the Fostex, the 10 per second rate is replaced with one flash per frame.

The source plate is 42 in. in diameter with 100 parallel lines, 841 in. wide and spaced 541 in. apart. Lines and spacing are accurate to within plus or minus .001 in. The source plate was made in Northrup is applying a precision, scientific etching type to a 1-in.-thick glass plate and cutting the tips with a specially adapted tape turning machine. Alternate strips have removed and a 1-in.-thick glass plate cover applied to form a sandwich.

The cylindrical reflector has a 53-in. clear aperture, is formed by laminating glass fiber with a high temperature epoxy over a plaster negative. The surface is vacuum-formulated and lugs-mounted for stressing and evaluation resistance.

The optical panel is designed for operation with only one activation switch with either camera. The drive firing pulse automatically is switched to provide the proper rate. A fraction display of illuminated portions of different colors is supplied.

Calibration for duration versus distance is by use of a standard counter-tape, wedge, prism, required to make this the tool calibration system is calibrated.

Space Lab Would Orbit, Return Scientists

Dallas, Texas—Manned space laboratory capable of supporting three scientists and 671 lb. of test payload, developed as a modular concept permitting maximum utility of the basic concept for maximum after space missions to lower costs has been conceived by a joint program of Chance Vought Aircraft's Astronautics Division and Hughes Aircraft Company's Los Angeles and Los Angeles. Dallas believes that their concept could be placed into orbit within six years.

Concept provides for a space laboratory and separate scientific vehicle, the former measuring in 40 100-in. orbit, while the latter is used by personnel who return to earth. Both would be launched into orbit by a Saturn booster.

the Satellite for the scientific vehicle, a living maneuverable body, separate from the laboratory and using a joint return to a preselected landing site on earth.

The space laboratory has a total weight of 10,000 lb., with its own vehicle weighing 5740 lb. and the Satellite weighing 4140 lb., including 675 lb. of test and associated equipment.

The approximate \$9.6 million cost for the program would include 17 crew vehicles and nine Satellites. Costs would include:

• \$12.1 million for a construction 8-

satlab and scientific vehicle. A second complete assembly would cost \$27 million including booster and launch support costs.

• \$295,600,000, the largest cost item in the program, would be expended on engineering effort. All testing would amount to \$2,770,000,000.

• \$49,500,000 would have to be expended on research and development. \$10 million on crew training, \$55.5 million on range modification, \$19.2 million for training and \$12.1 million each to be spent for spare and support cost.

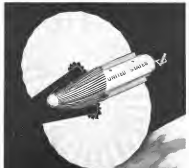
THREE-HUMAN SPACE STATION proposed by Chance Vought Aircraft Astronautics Division requires two large, mid-life, structures mounting side rails to provide additional power for the uncrewed vehicle. Concept shown would support men for two years.

Five-Year Schedule

Detailed feasibility analysis for the system by Langberg and Dolan in the form of test knowledge, obtainable in shorter than expenditure has such a program would reach about \$8.5 million of the next three-quarters of the expenditures would be in a new research station. During the development in a five-year schedule, this is, maximum test run funding research would be \$294.7 million. This does indicate the program relatively into current national space program.

The station proposed utilizes a modular concept of separate, crew vehicle and space station designated Satellite. The upper and lower fan-shaped light weight structures on the uncrewed vehicle would support solar cells to provide 5.5 kw. of electrical power for the Satellite.

Langberg and Dolan have the vehicle 100 in. orbit in the fact that this would represent a low space environment while also avoiding major expense to the launchers vehicles in the Van Allen radiation belt. Station is designed to support three men for 14 days. In return, the two would have



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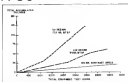
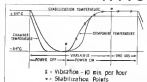
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AVIONICS



TEST CYCLE for AGREE reliability tests includes two-hour-plus temperature stabilization time at elevated temperatures with power on, followed by a cooler period at cold temperatures. Equipment is subjected to 30 min. vibration every hour during tests. Shown at right are AGREE reliability test results on an ARN-21C Test set. It is the first complex avionics equipment to undergo such rigorous tests. Two subgroups were required to reach the 75 hr. maintenance-between-failure (MTBF) goal. Air Force then released into the field air, but imposed emergency to increase the MTBF after producing 1,000 sets.

USAF Expands Use of Reliability Tests

By Philip J. Kloss

Bethesda—Air Force is rapidly expanding its use of the "get tough" reliability tests, developed several years ago by the Defense Department's Avionics Group on Reliability of Electronic Equipment (AGREE).

The Avionics Group's Systems Center here, which pioneered in the application of AGREE tests to avionics equipment, now has the permit to include in nearly 40 contracts in long or medium range—those according to Col. Edward McKillop, chief of ASG's Communications and Reconnaissance Division. Except for bombing ranges, none is a drone, this division has used USAF's performance systems equipment.

Tests on the new B-100B Electronic Warfare ARN-21C Test set, which is a test set for the ARN-21C Test set, has demonstrated a 75 hr. MTBF in field tests which is four times the figure for other ARN-21C equipments.

Careful Monitoring

First of the ARN-21Cs to be certified in operating squadron will be accepted under a carefully controlled test program to determine the equipment's actual MTBF in field use in order to establish the figure with the MTBF allowed in factory tests. Air Force, also sets data on the specific types of failure that occur in the field to determine whether they are the same as those found in factory AGREE tests.

Professors indicate that the AGREE tests are much more severe than actual field use and that the ARN-21Cs should operate for several times

the mean time between failure figure experienced in the former tests.

Under the terms of the original ARN-21C contract with Holloman, the sets were required to exhibit an MTBF of 150 hr. when subjected to AGREE tests. The earlier model ARN-21B sets exhibited an MTBF of only 17 hr. when subjected to the same tests.

With this equipment redesign and several years of reliability improvement effort, Holloman has been able to boost the mean time between failure of the ARN-21C to around 75 hr. Air Force agreed to raise the 150 hr. figure for the first 1,000 equipments (now only a 100% success count is required).

For an aircraft whose typical missions last for three hours, a 75 hr. MTBF with a 75% probability of operating throughout the entire mission, whereas a set with a 75 hr. MTBF has a 50% probability of operating for the full mission.

Logically, duration are the goals covered in maintenance tests. A 150 hr. MTBF with a 75% probability of operating for the full mission, whereas a set with a 75 hr. MTBF has a 50% probability of operating for the full mission.

Col. McKillop told Systems With, that his division carefully tracks production Air Force failures on the details of the AGREE tests and some then of their severity. The consequences of failing to meet the tests can be costly to a company.

In the original competition for the 545 million ARN-21C contract which Holloman won, price was a major factor and bidders showed three quotes to the best. When Holloman subsequently

had to take a winner on the 150 hr. MTBF in order to get Air Force to accept the sets, the company had to accept a discounted revenue in original contract price, McKillop says.

Test Problems

Holloman's problems of getting the ARN-21C to pass the AGREE tests was made even difficult by the fact that the set was not originally designed to meet these stiff tests and the type of corrective actions which could be taken in modifying the equipment design was limited by the fact that the ARN-21C had to be interchangeable with earlier models in the field.

When equipments are designed from scratch, with the AGREE reliability tests in mind, they are a less difficult hurdle, according to Capt. Stephen K. Skolodnick, of ASG's Navigation Branch. His job is to, for example, the AN-AR-10 and AN-AR-64 (navigation data links, developed by Radio Corp. of America, for use on the Convair F-102, McDonnell F-103B and Convair F-106. Problems tests to date indicate these equipments will have no difficulty in passing the AGREE tests.

In a recent competition for a maintenance enhancement landing system contract which led to seven X-100 (several severe) environmental test conditions a company without previous experience, such such equipment submitted a quotation that was about 25% less than the next lowest bidder. Before making a contract to the company, Air Force representatives indicated it was just as difficult to be certain they understood the risks and responsibilities involved. When the company and it did, and that it was intentionally under-



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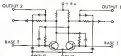
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bedding connected tests to get into the field. As Power avoided at the contract.

During the past year, approximately 25% of the semiconductor devices tested at the AGREE test process, in terms of dollars, have included the AGREE reliability test process. Automated Systems Center and other military groups will be switching circuits the results of initial 500 tests on the ARN-13C to determine what the additional reliability other tests in actual improvement in system for the extra cost.

Not all military users are willing to pay the extra costs involved in the AGREE tests. For example, in a recent procurement of AN-ARC 55 single additional equipment for the Strategic Air Command, Colfax Radio told the Air Force, it would have to increase its price by nearly 80% if the AGREE tests were included. Because initial results of the ARN-13C in service already are, including reliability, reliability, SAC was not willing to pay the price and so the tests are not being processed to the AGREE specifications.

(Due to 1 mil. procurement offered suppliers that the price quoted by Colfax might have been less if the company had not been the sole source for the ARN-13C and so if the company had had previous experience with the AGREE tests.)

Test Levels

There are four different levels of environmental severity for the AGREE tests, depending upon the intended use of the equipment.

•Light (L) Level: Equipment is operated at 50°F ambient temperature for three hours plus time required for equipment temperature to stabilize, then power is turned off and ambient temperature is dropped to 60°F for some period of time, then temperature is raised again to 80°F. Cycle continues for at least three times the length of the required mean time between failures (and specified for the equipment). Tests for a 100-hr MTBF requirement, equipment must be cycled until it has operated with power on for at least 490 hr, or until three weeks. Tests in vibration included in the Light Level and input voltage is the nominal value. This L-Level test is completed in ground-based equipment a high operator is controlled environment.

•Medium (M) Level: Equipment must operate through a similar test cycle, except that ambient temperature, during power-on condition at 110°F and equipment is cycled to 100°F during period of power off. In addition, equipment is subjected to vibration of 25 g's, plus or minus 0.5 in amplitude without shock vibration counts for 10 min. Test of each hour of operation. Input voltage is 90% to 100% of nominal type used for equipment. This M-Level

test normally is required for shipboard equipment.

•High (H) Level: Equipment operates through similar test cycle, but power is ambient temperature is 100°F, followed by equipment cooling to

—50°F. Vibration and input voltage are same as for M-Level tests. The H-Level normally is used for airborne or space equipment, such as Titan.

•Extreme (X) Level: Similar to H-Level test, except that equipment



Terrain Avoidance System Tested

Flight tests of an experimental terrain avoidance system, developed by General Electric, are under way at Edwards Air Force Base, Calif. The system will begin use in the F-4 Phantom II fighter jet. The system is a terrain avoidance system which can test the skills of human pilots and the automatic terrain avoidance system to maneuver aircraft during low-level flight. The system, which was in F-4 cockpit, was adapted to test a pilot's reaction to some early type of terrain avoidance system. System was under development in CAL for the past few years.



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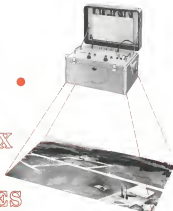
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OPERATING MODES On/Off, Standby, and Full Operating Modes	ON/OFF MODE On/Off, Standby, and Full Operating Modes
OPERATING PRESSURE RANGES Full Range: 0 to 100 Pressure: 0 to 100 Pressure: 0 to 100	ON/OFF MODE On/Off, Standby, and Full Operating Modes
OPERATING PRESSURE RANGES Full Range: 0 to 100 Pressure: 0 to 100 Pressure: 0 to 100	ON/OFF MODE On/Off, Standby, and Full Operating Modes

must operate at ambient temperature of 100°F, then be cooled to -40°F. This level normally is used for reference against equipment which must operate in extremely rugged environments.

During pilot production run on the ARN-21C, engineers Hoffman was required to pick seven sets from a total production and subject them to a 5 hr power-on operation, with 10 min of vibration each hour at a 1000 ambient temperature. Six were then cooled to -40°F for about 5 hr, then returned to 70°F and the clock resumed for 150 hr, or until sufficient failures occurred to punch halting the whole test. If a set fails during test, it is taken off, repaired and returned without attempting any tests or other operations.

During these initial tests a new age of the seven equipment experienced a total of 144 failures, giving an average mean time between failures of only 171 hr—a long way from the 150-hr MTBF required by the company's contract.

Even before the samples submitted to Hoffman engineers to determine its true state. Within the minutes imposed by the requirement that the ARN-21C be interchangeable, each color match the company set about introducing reliability improvements. These included such things as installing a larger capacitor cooling the relays, using the power supply in just regulated rails, better voltage, changing to a new type of quality components and modifying circuit errors.

Failures Cut

Another seven sets of the modified design were then placed in test. After each had operated for 150 hr, Hoffman found that the number of failures had been cut to a mean less than half to 74, but the average MTBF was only 54 hr, still far short of the goal.

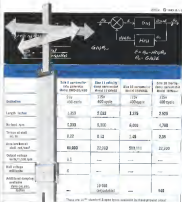
Again, seven failures were carefully studied. The analysis showed that in some cases the modified design had been cut, but in some cases the failures had been cut. The analysis showed, however, that the modifications had greatly reduced the number of tube failures.

After another design modification and reliability improvement effort, Hoffman reached a MTBF of better than 75 hr this spring. Air Force decided that it would be foolish not to release these sets for field use. Hoffman is then was for improvement to show in use. Hoffman Hoffman is required to maintain to peak up the ARN-21C maintenance between failures with a figure of

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size 8's that do the work of 10's...15's with 100,000 rad/sec² acceleration... 11's and 18's with inertia or adjustable velocity damping. Extract your solution from an infinite of micromax servomotors.

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Ryan research finds new ways to get off the ground

Ryan is the pioneer and leader in vertical jet flight—the shortest and quickest way into the sky—with more than three million man-hours of research, design, and engineering experience with VTOL aircraft.

The world's first pure jet VTOL aircraft, the Ryan X-15 Vertijet, set a milestone in flight technology when it made its spectacular demonstration flights at Edwards AFB, and Washington, D.C. It was designed, developed, and built by Ryan four years ago for the United States Air Force.

Advanced knowledge has also been gained in the VTOL/STOL field with the Army VESRY aircraft, a turbo-prop-driven research plane which Ryan designed and now has under test for the Army and the Office of Naval Research. It employs the deflected slipstream principle.

Now Ryan is underway on a new Air Force study contract for an even more advanced VTOL concept. It is the Vertibon which provides, as a single propulsion system, thrust for both vertical and high-performance horizontal flight.

In the electronics field, Ryan is a recognized world leader in continuous wave doppler navigation systems. Ryan developed the first successful C-W doppler navigator—the most effective new method of aerial navigation for both high and low speed flight. Today Ryan navigators guide all types of aircraft, from helicopters and slow flying reconnaissance aircraft to high altitude supersonic jets.

Ryan's bold research plans in VTOL aircraft and navigation systems have blazed a trail toward a new generation of military and commercial aircraft with increased capabilities.

RESEARCH BY RYAN has produced a unique, new "slipstreaming" technique for making lightweight casings of very high strength. Ryan now uses this process, called Ryan Wrap, to build coolant chambers for the Navy's submarine-launched Polaris missile. This stage of steel is now wound around a machined and electrolytically welded steel solid form.

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Titan G Fired Full Range



Area III, IV test range was rerolled on the stand. The rocket body, which has a truss-like structure, is shown in comparison to the RVN-1 and -4 areas. Shot was the Titan G's go full range and took action in a new vehicle was one of the G series and will be followed by the J series operational prototype.



First SAC office to act as test conductor on a Martin Titan environmental talking, made long. Capt. Albert B. White was the first to make. Shot was to serve as a Titan test but the retired detection satellite collaboration.





Sikorski S-55 approaches parachute with boat hoisted by wooden boom. At right, pilotless boom was falling chute.

Helicopter Demonstrates Chute Recovery

Orangeburg, Del.—Aerial recovery of paratrooper reports in terms of helicopter is depicted for the recovery of target chutes and guided-in-flight systems. The feasibility of the recovery system was demonstrated here to Navy, Navy, Air Force and Marine Corps representatives.

All American Engineering Co., Wilmington, Del., developed the helicopter system on contract with the cooperation of the 3d Marine Aircraft Division of United States Corps. The Delaware company developed the system which involves aerial recovery of parachutes. The system has yet to be tested under actual conditions due to failure to drop a jumping parachute which, when the parachute opened, was

The test drops were made from a Port of Force drop of 7,000 ft. Average descent of 1,500 ft. was achieved with a 24 ft. parachute which is a diameter of 18 ft. The helicopter, a Sikorski S-55 fitted with a grappling hook, approached the de-

scenting chute from about two miles out, within a mile of approximately 70 ft. The hook is fitted to the end of a wooden boom for stabilization and it snags the chute at which point it is released to fall the chute behind the helicopter. Equipment check is required to be in VI (vertical) position every 100 ft. or so.

During the last successful test, the chute was caught by the grappling hook and was hoisted to the level of the helicopter. The helicopter's main rotor blades, however, made several revolutions as the chute passed before the chute struck the ground. After the parachute was caught, the trailing rope was cut and the chute was hoisted to the level of the helicopter.

Maximum weight recoverable with Sikorski helicopter is 10,000 lb. to 15,000 lb. to 15,000 lb. to 15,000 lb. according to the manufacturer. Sikorski says that its S-55 helicopter can recover up to 15,000 lb.



Upon snagging parachute twice downwards effect shown left; cable is released from boom and chute is hoisted to recovery area.



EQUIPMENT

Altimeter System Corrects Pitot Error

By William S. Reed

Los Angeles, Calif.—Pitot-static, static-pressure measuring system operating in conjunction with standard, non-sensitized altimeter, has been developed to eliminate altimeter error due to static pressure error.

Produced by the Garrett Corp.'s Aircraft Manufacturing Division, the system corrects error in the measurement of true altitude pressure, caused by installation error of static pressure sensors or by variations in measurement of static pressure from changes in Mach number, lack of attack, or vice versa.

Essentially, the system solves, in varying degrees, the relationship between indicated static pressure and true static pressure as determined by airspeed and attack or deflection during flight test. It is designed for use in both civilian and commercial-type aircraft and does not alter the use of static pressure error correction cards when installed.

Indicated static pressure (P_i) from the pitot static sensor is accepted by the pressure converter which converts this value to true static pressure (P_t) by compensating for position, Mach or angle of attack error.

Resulting true static pressure output is an actual pressure, rather than an electrical representation of pressure.

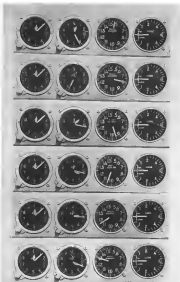
Inclusion of the static pressure component in the pitot static output provides corrected static pressure to be relayed directly to the cockpit instruments.

How It Works

In operation, the static pressure component functions as a false barometric transducer. Forces applied to the barometric sensor are proportional to the indicated static pressure (P_i) and true static pressure (P_t). The static pressure converter calculates the position of the barometer for the barometric sensor and thus schedules the ratio of P_t (the input) to P_i (the output).

When a rate of change position is scheduled, the barometric sensor is caused by a pressure ratio which either adds or subtracts pressure to the output (P_t) until the barometer is balanced. Engine bleed air is used as the positive pressure source. Negative pressure source is obtained through the use of a jet pump.

Multiple installation of instruments in the pitot static system is permissible.



CHARACTERISTICS shown on test panel mockup are those obtained in a Century-series fighter aircraft. The Garrett Corp.'s Aircraft Manufacturing Division computer simulates the error which can occur due to static pressure error. The panel shows the relationship between true, indicated altitude (feet), indicated altitude (feet), and Mach number (feet). In the first row, a 100 ft. error is evident at a speed considerably below Mach 0.50. In the second row, the error is 100 ft. at Mach 0.75, jumping to 1,200 ft. at Mach 0.95. The error is greatest at Mach 1.05 due to Mach effects, but drops off at 1.15 and becomes zero at Mach 1.30. The Aircraft Manufacturing Division is designed to be used in military and commercial aircraft and eliminates the need for static pressure error correction cards when installed.

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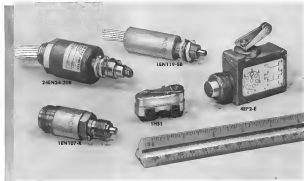
Explosive shock or high temperatures from missile exhaust present no problems to Micro Switch "HR" switches. They are hermetically sealed to maintain constant operating characteristics regardless of changes in atmospheric or environmental conditions. "HR" switches operate dependably in a temperature range of -45° to $+160^{\circ}\text{F}$. All exposed parts are corrosion resistant. To qualify as a true hermetically sealed switch, the chamber containing the switching elements is evacuated and filled with inert gas, the conductive sealing is glass-to-metal and metal-to-metal, and the contained switching unit is actuated through a sealed metal diaphragm. An air scraper ring on the actuator shaft removes ice or mud which might cause jamming or binding. Write for Catalog 77 which describes "HR" and other Micro Switch enclosed switches for airborne equipment.

12HR1-S and **12HR1-5**—Both contain two single pole double throw instantaneous switching units. 5 amp (resistive), 28 vdc.

12HR4-S—Has high temperature lead wire extending from its specially threaded metal hub. 5 amp (resistive), 28 vdc.



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1EN107-4 Meets BUOILD requirements, can withstand 1,000 pounds of air water pressure per square inch. Has two high shock limit switches. Write for Data Sheet 176.

4DP2-E Secure latching, exceeds shock and vibration resistance tests MIL-S-6745 and MIL-S-6744. Also meets antennae test for MIL-S 5272A. Contact hull houses

sealed solder terminals and diaphragm seal gland. Write for Catalog 77.

1EN1 Single-pole double-throw contact arrangement, conductors sealed in glass. Metal housing is evacuated and filled with dry inert gas under pressure, a true hermetic seal. Write for Catalog 78.

1EN110-00 and **24HN34-208** Both are used on missile test stands. Exceeds one-pound tests with ice scraper rings on actuator shafts to remove ice or mud which might cause jamming or binding. Write for Data Sheet 176.

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FOUR-PLACE 1960 Bellanca 260 sells for base price of \$18,990. Optional equipment might raise price to \$24,990.

Aviation Week Pilot Report:

Bellanca 260 Flies Well at Varied Speeds

By Herbert J. Cohen

Teterboro, N. J.—Wide speed range—ranging from a still at 40 mph to a 280-plus high cruise indicated—surpassed at 4,980 ft. characteristics of the 1960 four-place Bellanca 260 Cessna's a single engine airplane, offering plenty of speed and fuel saving.

Compact and yet comfortable, the 1960 Model Bellanca retains the Bellanca all-wood wing concept unchanged since the Bellanca Courier first flew

in 1936, but has moved into a new, fast-lag cruising, trouble landing gear and redesigned cabin. Gross weight is 2,790 lb., useful load is 1,010 lb.

The Cessna's is produced at Alexandria, Minn., by Downer Aircraft Industries, Inc., on a 11 per month production schedule. Downer Aircraft's 150-man work force has been welcome trained in aircraft production by top management which originally planned to build the Republic Seabee under license (AW Mar 10, 1958, p. 51).

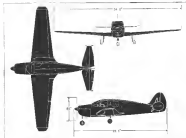
Downer Aircraft will name the Seabee right, but has concentrated on building the Bellanca since the 260 rights were purchased from aviation pioneer Giuseppe Bellanca. Now called Bellanca still keeps an enthusiastic interest in a Seabee and design changes are underway in which the 260 changed to travel gear.

The Alexandria firm is headed by J. R. Downer, a former Seabee. Many manufacturers who founded the Republic Seabee Co. and entered the aviation field when he purchased a majority interest in Northern Aircraft, Inc., from Ron L. Strong, of Alexandria, who is no longer associated with the company. Robert Claggett is chief engineer and test pilot.

Acceptance of the Bellanca 260 in the business flying and executive market is indicated by its production rate increased monthly from 10 to 12 a month. Downer Aircraft sold 80 airplanes last year and present indications are that the figure will be topped this year.

Downer Aircraft follows a hot rate in planned obsolescence, i.e., changes in models are not drastic and for still purposes alone. Company said this procedure tends to "stabilize and maintain the 1960 values and prices of these units now in the market," keeping resale value high. The firm now has 10 distributors.

The Cessna's sells for a base price of \$18,990, a cost that makes it competitive with the base price of the Beech Model 55 (\$19,995). Page 293



BELLANCA 260 dihedral at 4 deg. 30 min. Incidence is 0 deg. at root. 5 deg. at tip.



PAINT SHOP at plant at Alexandria (N.H.) Airport is shown at left. At right, Bellanca 260 wing is covered with 1216-in. mahogany plywood which is laminated to give bond quality. After gluing and temporary tacking, wing is dipped in resin tank for sealing.



(522,800) and Cessna 210 (\$22,490).

Downer does not attempt to match other production facilities or advertising and promotion budgets with those builders, relying more on engineers' field sales tactics and word of mouth to sell the plane.

At 180, the Cessna's cost to the owner with optional equipment and fueling a full gas panel and main compartment, etc.—would range from \$21,900 to \$24,900.

Downer Aircraft does not financing. Having that plan, of the operation is to distributors and dealers.

It is a source of particular pride to Downer Aircraft that Federal Aviation Agency has set to issue an Airworthiness Certificate for the 260 requiring either builder or operator compliance to a safety defect.

Continental Engine

The Cessna's is powered by a 260-hp Continental KO-470-B horizontally opposed, fuel injection engine, because of this feature, used for carburetor heat is eliminated. Fuel is 100/130 octane. Major design changes include: a 44-hp fuel injection engine, called 100/130, which the company says has saved about 30 lb. in weight and provided considerably more strength and life than the previous bellanca cloth 130-hp carburetor engine.

• Redesign engine mount designed to reduce longitudinal stresses and vibrations caused by high compression peak-to-peak and high rpm settings. • New blade system has been changed from the left wing to reduce to a motion on the pilot's side, offering



CRUISEMASTER's 200hp Continental KO-470-B engine has fuel injection. New gear is removable through rubber pulley. Gear is independently powered and rotates in 4 sec.

better air flow and control. Outlets, with controls, have been provided for both front and rear seats.

• Rear seat back has been made higher and 2 in. more head room, plus an inch or so shoulder room, has been added. Passengers also now have access from the rear cabin to the 165-lb. capacity baggage compartment behind the seat.

Upholstery is color in varying shades.

• Basic three-color Bellanca design pattern has been retained, but the customer now can choose from 10 different colors.

An evaluation by the Air Corps.

When met, accompanied by David

Nauck, Douglas Aircraft's sales division sales manager, showed the Cessna master to be an honest, highly stable aircraft which is easy to fly and has good slow flight characteristics.

Plane flown at Tibroboro Airport, N-7600E, was a new demonstrator with less than 700 hr on the airframe and engine. On the ground, the 350 has a slightly nose-up attitude, caused primarily by a company decision to make the nose wheel the same size as the main gear for maneuverability and strength.

Taxiability, however, is excellent.

Getting into the Bellanca is a bit tricky for the newcomer. First, he



FLAP SECTION for Bellanca 540 is assembled (above). Below is baggage assembly, made of 4032 corrosion-resistant alloy. Note auxiliary tank below baggage compartment.



EVOLUTION & REVOLUTION

REVOLUTION in electronics may have its genesis in the evolution and synthesis of four prime areas: the rapidly maturing technologies of semiconductor development and production, surface passivation and stabilization research, electronic ceramic engineering and controlled thin film deposition. Synthesis of effort in many scientific and engineering disciplines is required to achieve breakthroughs in these areas and accelerate the evolution from conventional to microelectronic circuitry. The Solid State Electronics Department of Motorola's Military Electronics Division is exploiting this approach as the key to long life and reliable performance of electronic equipment by eliminating excessive complexity in component interconnection.

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5. engine systems development

I have used each of these in the past and am interested in the use of them in the development of the aircraft. I am also interested in the use of them in the development of the aircraft. I am also interested in the use of them in the development of the aircraft.

I am also interested in the use of them in the development of the aircraft. I am also interested in the use of them in the development of the aircraft. I am also interested in the use of them in the development of the aircraft.

Very truly yours,
W. B. Trout

If you can write a letter like this, please do it immediately. Kaman would like to have you aboard. Many attractive positions are waiting to be filled by men looking for a ground-floor opportunity.

THE KAMAN AIRCRAFT CORPORATION
BLOOMFIELD, CONNECTICUT

Largest independent producer of rotary wing aircraft in the U.S.A.

Bellanca 260 Performance

Maximum cruise speed	210 mph
75% power (at 6,000 ft.)	201 mph
Engineered cruise (45% power at 10,000 ft.)	165 mph
High speed (one level, full throttle)	205 mph
Never exceed speed (V _e)	212 mph
Rate of climb (sea level)	1,712 ft./min
Service ceiling	22,800 ft.
Stall speed (landing configuration)	48 mph
Stall speed (one flap up)	47 mph
Cruising range (75% power, 5,000 ft., 179 mph TAS)	835 mi.
Takeoff run (50 deg. flap) sea level, zero wind	990 ft.
Landing run (10 deg. flap) sea level, zero wind	460 ft.
Takeoff distance to 50 ft. one flap, zero wind	400 ft.
Landing distance over 50 ft., full flap, zero wind	490 ft.
Landing speed	45 mph

200 ft. although the stall warning was sounding in my pulled off the controls. Given a substantially powered and steady climb it was. When returned, the wheel protruded slightly in a rotation to one of a wheel-up landing.

Checkout was made at approximately 110 mph, and 1,600-1,700 ft. The Cessna 260 is a superb aircraft in a surprising light and, despite extreme turbulence, we climbed to 10,000 ft. in a few minutes. The turbulence contributed to the evaluation, in that the airplane corrects itself from an off level angle it is forced into. At least the Cessna 260 could be flown hands-off through the turbulent area.

At 6,000 ft., where temperature was 16G we leaned the engine to 45%



ACCESS to both front seats is the 260 through the right door. Power controls are on either panel.

power for a long-range cruise speed (check, using 2,800 rpm and 70 in. manifold pressure). The airplane stabilized at 153 mph (one engine) at 175 mph, using 24 in. manifold pressure and 2,470 rpm; the plane's true airspeed was slightly more than 180 mph. A more exact reading was impossible due to fluctuations in the original instrument panel by the turbocharger.

The Bellanca handles beautifully in the stall area. For one thing, the plane must be flown into a stall, and then it will, unprovoked, after pulling the plane in an angle as steep as to become uncomfortable—no one ever about appeared to be slightly more than 45 deg.

The Cessna 260 is fitted with a stall warning indicator (horn) actuated by 5 gals. on the left wing. The horn sounds about 10 mph before the stall is reached.

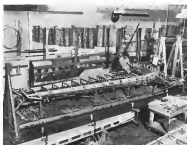
On a clean stall (one flap up, one on 10 in. manifold pressure) the Cessna 260 stalled at slightly under 10 mph indicated airspeed. There was some buffeting, but no break; the pilot finally advanced the wheel, letting the nose drop through the hump. The sharp nose—approximately 60 deg. nose down—could have been held indefinitely without a break, although the Cessna 260 stalled slightly.

With gear down and full flaps (46 deg. lift wing, 10 in. manifold pressure and 2,000 rpm), the stall warning horn sounded at 58 mph and again the plane reached stall point at under 50 mph. This time there was a slight head to the right—but the Bellanca corrected itself.



Champion Model 7JC Has Steerable Tail Wheel

Champion Model 7JC Tri-City has inside landing gear with tail wheel which is steerable through the cabin, parallel with or on the ground. In flight the tail wheel automatically assumes a straight ahead position. This inside landing gear is used by field operators according to Champion Aircraft Corp., Detroit, Wis. The gear also overcomes the tendency of a conventional tailwheel gear to flip in a quartering tailwind. Champion says: "In a normal landing all wheels touch almost simultaneously. All three wheels have shock absorbers which will begin absorbing the landing impact before the rear wheel's shock absorber is fully compressed. The pre-landing run then appears without forces or movement. Champion says: "Base retail price of the 7JC, which is produced only in 100 low volume is \$6,495.



WING is built up at factory in downtown Alexandria, N.Y. Here also are being glued to the system. Steadiness and temperature are controlled during gluing and curing.

The Bellanca's slow light capabilities are excellent. For instance, acting up the speed at 65 mph 135 (150 in. manifold pressure and 1,700 rpm) the plane was trimmed and high. It climbed slowly at a gentle turn to the left (altitude at about 130,000 ft.), a condition which is better down through currents. The left turn remains flat but it does not digress into a sharp spiral.

It also can be flown hands off during

the maneuver. Flight visibility is excellent although the position of the two upper windows mentioned earlier are somewhat annoying.

None level is moderate and a cross current can be held at slightly higher than normal rates at 75% cruise power.

Flare has a broad ladder from left, the elevator trim is located above the windshield and is operated by a left right crank. There is a turbulence, forward elevation for the left hand side, nose the indicator is free and left and it is to be used, normally at first is to have the plane the opposite nose from desired.

Gusty Wind

Earlier, wind conditions remained strong and gusty—still 20-25 kt and 35 deg off the active runway—when we returned for landing. Landing traffic, speed was reduced to about 130 mph and gear lowered, level in as the flow between the plane and compensates a metal hook in guard against inadvertent winging. Both gear and flap levels (30-40 ft.) put to the right (reverse to normal position) after activation.

Flatten was firm at 125 mph, faster than usual because of turbulence, and we dropped about 15 deg. flap in first, making a fairly the approach with an unobscured, road to keep the approach heading constant. A gust hit an elevator peeling the 200 to the left side of the runway, but the plane remained controlable and control was held at about 70 mph. Landing was short. Main gear wheels hit in slightly at the top for ground stability in constraints.

On the maximum performance take-

off, Nicoll dropped 15 deg. flap and used full power, holding brakes on. When brakes were released, Nicoll bailed back on the loaded column and the Bellanca rose off the ground in about 150 ft at about 50 mph. We rose 180 ft high at the end of the 5,000 ft runway, climbing at nearly 2,000 fpm at 90 mph. There was no risk when flaps were raised.

Next landing was made at a higher approach speed (about 110 mph) and higher final approach angle, to cut the previous climb phase entirely out of the runway, smooth and again the landing roll was quite short.



Emerging from parts in hand, Air Force chief test pilot George O'Shea, one of those designated to use an UAV, tests an America.

LOGISTICS PROBLEM—SOLVED BY CESSNA

Problem: To provide the Air Force a quick, easy, economical way to recover its valuable fleet of Cessna U-3A light twin transports, Robinson, a worldwide off-the-shelf support program tied in with Cessna's world-wide support of the U-3A's commercial counterpart, Model 310. In operation nearly three years now, the program has proved a success by many standards. Most important is the Air Force's trouble-free, trouble-free and fast service.

Low cost, low-cost support is just one of the reasons UAV flies the U-3A successfully—and one more of the ways Cessna's "It's never failing" Research is now at work enhancing America's future in the air.

Optional equipment includes installation of a Mitchell automatic pilot, three control unit—alt, prop and bank—with an automatic heading selector and altitude control costs \$1,120. Donkey Aircraft also offers a variety of communications and navigation equipment, plus flaps by Aeromax Wings, for instance, not fitted with a Nutsa Mark II Gyrograph with 27-channel VHF transmitter and overhead speaker which costs \$1,250.

Auxiliary fuel tank (20 gal) also is optional, at \$267 installed. Total fuel capacity, with auxiliary tank is 60 gal, giving a specified range of 913 mi. at



BAGGAGE COMPARTMENT has 165-lb capacity. It is accessible from passenger cabin.

44% power (10,000 ft, 18 in. maximum altitude, 2,000 fpm).

The Bellanca 206 is built in a plant at Alexandria Airport, although the wood wing is manufactured in a dormitory town location and trucked to the plant. Wing is a two-part structure, made of ribs spaced at about 400% stronger than the original prior of wood. Straps being laminated are kept under pressure for 24 hr; humidity is controlled to 70 deg. F and and raw tape weights are regulated. In order to provide fitting glider for the main landing gear on the wing, an additional laminated is made by thicker blocks about 11 in. and 14 in. on the ribbed side.

Engine wing is covered with 2/16 in. aluminum plating which is laminated to give hard quality. After gluing and temporary tacking the wing is dipped in a resin bath for fire setting. There is an additional ring from surrounding steel bands or damped spot welds, as with a metal wing.

Donkey Aircraft says the new Post-Rate handling wing has a high degree of strength, temperature variation, even in the environmental variations have no effect on the wing. Stretched strength test is to keep a 1-lb steel ball onto the covering from 60 in. to 100 in. apart.

The engine wing is hand dipped the steel ball from 30 ft without penetrating the glue, which also is used in 8 in. x high steel composite.

Although it is used in construction of the two-part engine wing, for an off-center wing. Cooling is secured with quick access inhibitors. The 200 hp engine is made of welded 4130 normalized steel tubing, welded in a tube-type structure.



SINGLE-SEAT Farnell AV-36 CM tailless glider exhibited at the meet. However no show was held under license by Apparition, Netherland, Netherland, Germany. It is based on the Farnell AV-36 glider prototype. The Farnell Farnell company now has a two-seat version under development.

Tailless Glider Has Engine for Takeoff

By Edith Walcott

Hanover, Germany—Single-seat Farnell AV-36 CM tailless motor glider based on the Farnell AV-36 glider prototype was among the Farnell Farnell company K&G exhibit at the Hannover air show.

Several Farnell AV-36 gliders were produced and are being in France and the Farnell Farnell company now has a two-seat version under development.

The model at Hannover was built under license by Apparition, Netherland, Netherland, Germany, a member of the Farnell group responsible

for the Farnell's production program.

The glider is fitted with a 14-hp lightweight two-cylinder, two-stroke engine made by Kleinschmidt GmbH, Vöhringen, Germany, which enables it to take off under its own power. Previous models had a single 41-hp Kleinschmidt powerplant and required either a launch or towing system to become airborne.

The tailless Farnell AV-36 CM has an

asymptotic single wing and fin in its longitudinal stability from wing break and controlled location of the center of gravity. The elevator is mounted like a flap in the center section of the wing. The aileron control is conventional. The two rubber safety arcs between elevator and aileron. The wing has a wooden spar and plywood covered fuselage from nose. The section behind the spar is fabric-covered. The

Farnell AV-36 CM Data	
Displacement	
Wing	100 sq ft (9.3 m ²)
Length	18 ft (5.5 m)
Aspect ratio	51.8
Wing area	107.1 sq ft (9.9 m ²)
Weight	
Empty weight	344 lb (156 kg)
Max. gross weight	381 lb (173 kg)
Gross weight	350 lb (159 kg)
Performance	
Best glide ratio	25
Maximum rate of climb	2,911 fpm
Maximum speed in horizontal flight	
Light over the ground	74.5 mph
Maximum rate of climb	4.9 fpm
Duration of powered flight	5 hr



Hughes 269A Powered by 180-hp. Lycoming

Model 269A, civil version of Army YHO-2HU (AWA-4, p. 88), is 22 ft 3 in. long, 7 ft 11 in. high and has a fuselage width of 4 ft 5 in. Empty gross weight is 3,550 lb, empty weight is 3,075 lb. Cruise speed is 51 mph. Operational range is 120 mi.

radon suits on, of similar construction. The workable lining is normally covered with fabric or synthetic material, in down. The snugest cockpit is a Pileup, crop. Refs the pilot's seat and control panel are adjustable. The single track landing gear has two wheels mounted in tandem under the fuselage. The rear wheel has brakes. The engine is installed behind the main gear in the center of the fuselage. It drives a multi-blade, 42-hp, ducted, semi-rigidly folding propeller to reduce drag when the engine is switched off. The engine is aluminum-cased and rated at 14 hp at 3,000 rpm. Fuel container holds 475 gal.

PRIVATE LINES

Garrett Corp.'s Advertisers Aviation Service Division, Los Angeles, is fitting Minnesota Mining & Manufacturing Co.'s Cosine 340 with an executive, remote-control special Minnesota Mining sound damping treatment and a Stern A-12 autopilot. Company's chief pilot is Frank Taven.

April shipments of U.S. business and utility aircraft totaled 211 units valued at \$14,454,000, at manufacturers' net selling prices, compared with 760 aircraft valued at \$11,960,000 in the same

month last year. April 1960 shipments included 120 twin-engine aircraft. In the first four months of this year a total of 5,044 business and utility aircraft valued at \$39,187,000 have been delivered compared to 2,851 units valued at \$44,020,000 in the same period in 1959.

Recent Bell Helicopter purchases include the Aviation Services, which received a new Model 47J-2 Ranger for general charter work in the San Francisco-Oakland, Calif., area. The Aviation unit reports from San Francisco International Airport that city's municipal airport on the down building deck to the privately-owned Hanes Helicopters at Conditon Park and to the Mountain view track, Lake Mountain Helicopters. In a newly leased service in Idaho received a Model 47C-1 which it will mainly use on charter to U.S. Forest Service. Aero-Boring Inc., Seattle, Wash., has added a Model 47C-1 to its fleet, totaling 15 Bells, which the company uses for timber spacing, seeding, geological work, and snow service.

Haggar lightplane, the low wing D-20, Pylon powered by a 118-hp Walter Mawor radial engine, has completed its flight tests. Single and two seat versions have been designed. Specifications, mid-wing, open, 34.4 ft length, 26.3 ft wing span, 172 sq ft Gross weight is stated to be 3,300 lb and empty weight at 1,244 lb. Maximum speed is given as 124 mph and range at 153 mi. Airplane closely resembles the Cessna 270B trainer.

Increase of 38% in commercial plane sales for the first half of fiscal 1960 are reported by Cessna Aircraft Co. Sales of \$30,620,000 for the six months ending Mar. 31 are compared with \$22,197,000 for the same period last year. Cessna also has all divisions for the six months period, totaled \$36,314,000, a 7% increase over the same period in fiscal 1959. Earnings after taxes were \$4,232,000, or \$1.31 per share.

Contact to do periodic overhaul of National Airlines' Pratt & Whitney JT-4 turbojet engines and basic overhauls has been awarded by the carrier to Southwest Airframe Co., Love Field, Dallas. Tex. Southwest Airframe expects to get its first National JT-4 over this summer. It previously had contracted with Bonnell Airframe to handle its JT-4s.

Piper delivered 226 business and utility airplanes in April having a total net selling value of \$3,499,218. It included in April shipments were 58 PA-15s, 11 PA-16s, 36 PA-22, Empenn and Combines, 45 PA-23 As,

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March 1990

Manufacturer and Model	No. of Ships	Net Billings
Aero Design 680 680B	1 1	\$1,000,000
Boeing 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500	\$1,000,000 \$1	

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WHO'S WHERE

(Continued from page 33)

In the Front Office

Shelby Thompson, director of the Office of Technical Information and Educational Programs, National Aeronautics and Space Administration, Washington, D. C.

Chauncey W. Roth, chief of the Management Office of the National Aeronautics and Space Administration's George C. Marshall Space Flight Center, Huntsville, Ala.

Honors and Elections

Col. Arthur J. White (USAF) winner of the national aeronautics essay at Dayton (Ohio) for the National Aeronautics and Space Administration's George C. Marshall Space Flight Center, Huntsville, Ala.

The Royal Aeronautical Society has awarded Roemer Fellowships to six Georgia Institute of Technology students in the fields of Aeronautics, Astronautics, and Space.

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TO THE ENGINEER

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If you are a qualified engineer, we would like to hear from you. Just drop a line indicating personal information or your background, interests, and accomplishments to: Mr. James E. Rice, Dept. 64-10, Honeywell Associated Division, 1630 Avenue Road, N.E., Minneapolis 13, Minn.

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LETTERS

True Deterrence

In reading the letter by Sir Ruth (AMM May 15, p. 124) it is not hard to see that it was indeed a needle protruding into the nether dogfish. There can be no doubt that because one doesn't believe that this does not cause correct diagnosis.

An analysis of Soviet strategy will show that they are willing to suffer devastating damage to their ships and bases, but if they can be assured of the survival of their own coast, most other basic needs, Western Europe. The use of our weapons to strike these targets would in the long run, a very poor investment. The probability of handling our missile ships does not lead itself to self preservation. Since it is our national policy to avoid engagement or war, therefore, growth, some means of covering our vessels of a nuclear attack. Perhaps Mr. Roth does not expect us to receive a first blow by the Soviets, even with land-based missiles?

The true nature of a distressed loan is that there is nothing causes the owner to walk away from attacking as the fear of incurring an unacceptable amount of damage to its overall governmental relations and national interests. For this reason, it is not good sufficient outside to walk, it is completely eliminate the owner's attacking fear. We need only a sufficient reward force to prevent the carry from attacking. We do not need, therefore, 1,000 needles to pin one to adequately deterrence.

We need not yet totally open ourselves, however, for there have many faults that are not easily solved by the use of musical words (This is not to say that we should do so without all music). The inability to scribble a sound is perhaps its most noticeable fault. The screaming note with tongue a mother Marmoset would not, therefore, a necessary. We must also avoid obscurity in our music. If at 15 Hz, say, the 8-10 will be insufficient for one note, then surely the 8-67, 8-52 and 8-15 are also not sufficient. We must also avoid the use of musical words to convey the best equipment available. For us, this is the 9-70. True, it is expensive, but then what other reason is one, according to us?

Mr. Smith stated that he is unable to see the desirability of any procurement policies. He is unable to fashion a better one or one containing any desirability or procuring one. Thought on this matter would simply produce the conclusion that the threat of a procurement war also constitutes a threat. He also seems to think that we are spending outrageous sums for the spread of our national stigma (including his own life). When we consider that the U. S. spends approximately 10% of its gross national product on defense while the Soviet Union spends approximately 14%, then perhaps we are not spending quite as much as myself thought.

As to the protection of our society, how can the military protect a people who apparently do not want to be protected? There have been numerous attempts to provide public housing by shelter. All have

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been bitten? If one has ever been on a large cat show in our red cloth, he would see the opposite lack of interest of the populace to take any heed of the drill. If we detested should fall then we will have to ask upon our knees, and we will have to protect to. Should we, therefore, not only protect the vital purposes of our to detest (SAGE, NERD 112) but also strengthen them? For myself, I do not consider not to detest as "anxious" as does Mr. Roth.

If it happens, one of us will have one definite spending-habit lesson: "blotting out consumerism." When our national income rises one after year, what do per capita incomes rise for after real and the real on demand in the country, a constantly increasing. The Soviet Union is trying to force some of the best of its money for consumer goods. The United States is trying to reduce its welfare. Should the United States of a robust democracy in much by adding also to spend less than 60% of its GNP on consumer purchases? Perhaps we could be in a better situation if the military might of the country, on the back of the Soviet Union, the United States, and the United States, the official money, were to be spent instead of the inflated money of the nation.

In reality, then, it is not a question of how much we are spending on defense, but rather how we are spending what we do spend. To paraphrase a prominent congressman—of no particular use to arms and it lasts for only one (and yet persons who, thus it was a necessary expenditure. Perhaps Mr. Smith should put more thought into the subject and examine a few authors before further "realistic rationalizing" onto the masses of our nation's defense.

(Name withheld by request)

Expert, USAF Academy
Colorado Springs, Colo

Radiation Weapon

I read the brief report entitled "Anti-NCBM Ra Research" (ANW Apr 11 p 38) with considerable interest. Two and a half years have passed since my letter concerning a salivary weapon appeared in your pages (ANW Nov 25 1987 p 126) and a nice situation has evolved. A device that would distribute and release a toxic and a half year ago, a new device worthy of development. My own spare time studies had to agree with Dr. Chazy, that industrial applications still exist but the successful development of a salivary weapon is not feasible.

The development of a radiation weapon such as a neutronisation bomb will be shaped by the strategy and factors governing the use of the weapon. Therefore, the

planning of home strategy and tactics should proceed systematically with the preliminary analysis of weapons configurations. In particular, the question of generalised versus specific-based solutions has to be decided quickly. It is no opinion that the use of generalised rule-based response will be ultimately better and that only by placing these weapons in a spot environment can we ensure a truly effective defence against A-bombs and their 10 brothers.

If the Russians began the first to explore manned satellites (and everything including the broader parts of our own space program points to that) it seems likely that they will establish a firm, unshakable base by saving or destroying any manned satellite, not put into orbit. Space will be used exclusively for the use of industrial expansion, and it is not probable that the Russians will claim a program of such magnitude.

Space segments will be at risk in the next two decades as we sit separately in the past 29 years and those who reflect upon flight in space and wonder at our crowding the United States in a fair more hostile than that of Hindians.

There is an element of this situation as disturbing as the probability of a Russian monopoly of space flight—the loss of touch between the western man and a satellite planet because theoretically possible and the possibility of a Russian monopoly of space flight. I can hope. From my own experience, I can state that the possibility of a Russian monopoly was apparent to the summer of 1948. Furthermore, although the United States had a large number of excellent public information staffs available to scientists, I had developed a basic concept of a dissemination team by the fall of 1946. Yet as far as I am told, no plan for a reduction campaign until 1958 and steady contracts are not set on foot until the spring of 1949. The CILSP-AP program (AWAC) for 1949, a 151 German-speak article, was not set on foot until the fall of 1949. Their own press, available.

If there is a more imminent defect in the present organization of national defense than occurs prolonged delay that defect must be corrected at once. We have no time to lose.

Agnes Magoon. In
New Bedford, Mass.

Gulliver's Travels

Your photo story on a flawed waste recycling system (AWA Age 25 p. 53) helped to nudge California's vote to the Grand Alliance of Ecology on Nov. 5, 1997. How is not a scientific matter, yet for many years had been engaged in the software task that Dr. Chapman is now working on. Let us wish the Decree more success than Dr. Sadeh attributed to his 1995 mission, reported

Thomas B. Friedman
Pacific Palisades, Calif.



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